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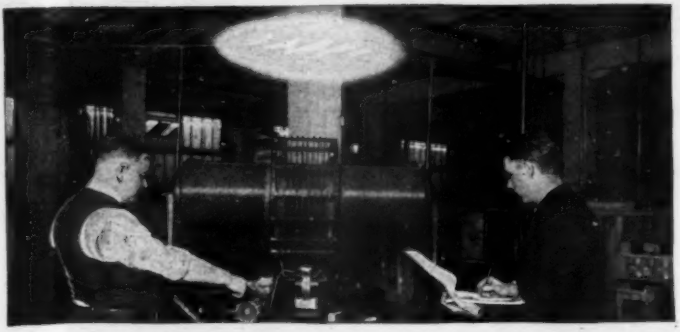

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Artist's Drawing of an Egyptian Tomb Interior like That in Which the Mummy of Pharaoh Meneptah Was Found, Hacked by the Axes of Robbers and Bearing Evidence of a Serious Heart Disease, Curiously Suggesting the Old Testament Words, "And the Lord Hardened the Heart of Pharaoh"—See Page 184

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Vol. 53 FEBRUARY, 1930 No. 2

Flying Over Jungleland

Photos Courtesy Army Air Corps

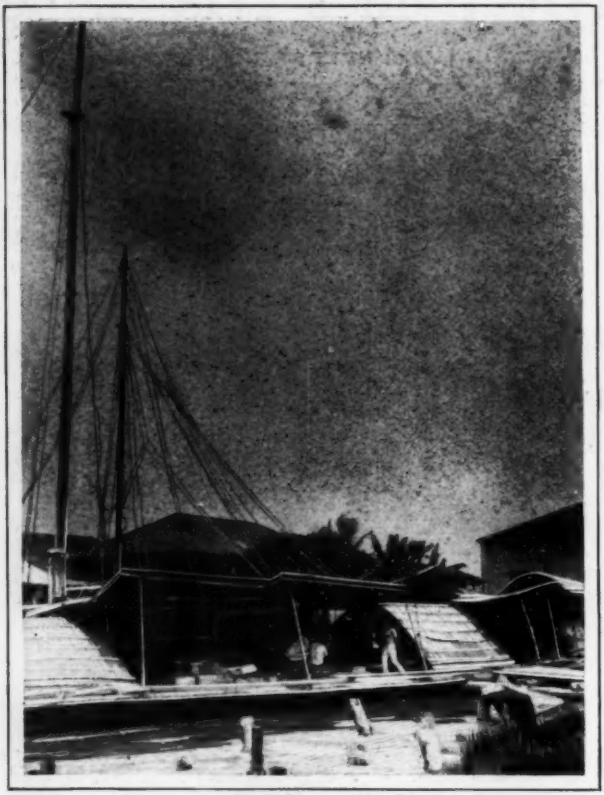
By LIEUT. GEORGE W. GODDARD, U. S. A. A. C.

AERIAL photography in the tropics is full of grief and thrills. In the Philippines it is necessary to use two planes which fly fairly close together so that, in case of a forced landing, one can return for assistance. The planes always carry arms, life preservers and emergency rations. Most of the cross-country flying is over shark-infested waters, swamps and flooded rice fields.

From 12,000 feet, the mountainous country of the Philippines appears very flat, carpeted a dark-green color with few landmarks, which were needed very badly in laying out our lines of flight. It was suggested that we experiment in dropping white-cloth parachute markers on tree tops at desirable points. We found, however, that the wild Negrito tribe which inhabits the Bataan peninsula section stole them within twenty-four hours, presumably using them for G-strings. It was decided that the best time to locate these markers would be the same morning the pictures were being taken.

On our first important mapping expedition, Lieutenant Wells was flying the parachute plane and I flew the photo-

Artist's Drawing of an Ex[illegible] of a Serious Heart Disease, Curiously Suggesting the Old Testament Words, "And the [illegible]



Swarm of Locusts near Landing Field in Northern Luzon; the Flyers at First Thought the Cloud Was a Dust Storm

graphic plane. From 12,000 feet, I could see the markers very plainly, but, after flying the second twenty-five-mile strip, I was unable to locate the next row, so I started looking for Wells' plane. Failing to locate it, I headed for the home airdrome. When I landed, Lieutenant Wells met me and described his narrow escape.

"Everything was going fine until I passed up a narrow canyon into the crater of an extinct volcano, but because of down currents of air and the fact that the rim of the crater was too high to climb over, I decided to turn around and fly back through the canyon. At a point about a thousand yards from the crater, I saw an enormous black cloud. It was not possible to turn around or climb over, so through I went, and oh, what a mess! Bats! Thousands of them. How they thumped against the wires, wings, propeller and radiator. Water began to stream out from the sides of the radiator and so I started for home."

Another exciting incident took place one clear morning on what we believed was our last flight over an unexplored section of Luzon. Our two mapping planes became separated. We proceeded alone with single-lens work. While circling around to afford Sergeant Stockwell an opportunity to reload his film magazine, we were both startled to hear the motor begin missing.

It was fifty-fifty—pick the rock-bound Pacific with chances of rescue very remote or try to reach our base or one of the few openings in the jungle en route. We took the chance of reaching our base. It was evident that there was water in our main gas line and carburetor, because, shortly after I had switched over to my emergency gravity tank, the motor functioned better and, after flying for about seventy-five miles with the gasoline hand pump going, the trouble disappeared.

As I was taxiing up to our tent, I noticed the natives pointing toward the east and discovered they were watching a swarm of locusts. Soon this black cloud was over the landing field and shortly after we heard the roar of Lieutenant Wells' motor overhead. We did not see his plane until he was part way through the swam of locusts, then suddenly his motor was run at full speed and the plane flew on and disappeared.

In a few minutes, the locusts settled and Lieutenant Wells landed. As his plane ran along the ground, the insects

How Rice Fields Look from the Air; Inset, a Native Woman Enjoying Her Cigar, and, Below, Traveling and Watching for the "Big White Bird," the Army Airplane Used in Mapping

flew up, giving the appearance of dust raised by a fast automobile. Lieutenant Wells told us that he had received the surprise of his life when he arrived over the field. He thought that this strange phenomenon was caused by heat waves or a sand storm, but changed his mind when the locusts started flattening out on his face and windshield. It was not very long before the entire village was out to our camp with nets and burlap bags which they filled. That evening we watched the natives sitting in front of their huts roasting and eating locusts, which they consider a great delicacy.

One day, while using an amphibian, we landed in a small bay with an interpreter to find out what the natives thought of us. As we taxied up to the beach the natives scattered, hiding behind trees. Presently one old man with bow and arrow in hand mustered up courage to approach within fifty feet of the plane. Our interpreter muttered a few words, and it was not very long before the natives lined up along the beach jabbering like a flock of magpies. After we were carried ashore, the interpreter informed us that we were the first

white men they had ever seen and that they had believed the airplane to be an enormously big white bird.

The last part of June, reports were being received in Manila that Mayon volcano was erupting and that the inhabitants of the villages near by were panic-stricken. The American Red Cross and the weather bureau were anxious to have aerial photographs taken of the crater and lava flow in order to show definitely the seriousness of the situation; so we started out.

The weather for 200 miles was ideal, but at a point approximately fifty miles from the volcano, we ran into a bad thunderstorm. We decided, however, to take a chance climbing over it instead of turning back, and for the next twenty minutes we gained our altitude and started milling through the passages between the clouds, which, as we proceeded, towered to 16,000 or 17,000 feet.

Suddenly, our plane was thrown almost upside down. Cameras flew in all directions and we both felt a dry burning sensation in our throats. We knew we were close to Mayon. Before Lieutenant Corkille could right the plane, we were flying blindly in a cloud; minutes seemed like hours before we had worked our way out and were rewarded with our first glimpse of the volcano with about 500 feet of its cone above the clouds.

It was a magnificent sight to witness the flames, clouds of ashes and yellow smoke belching from the crater. In a few minutes, more of the volcano became visible and we could see the 300-foot stream of molten lava pouring out of the fire pit and running down the side. Our return was without further incident.

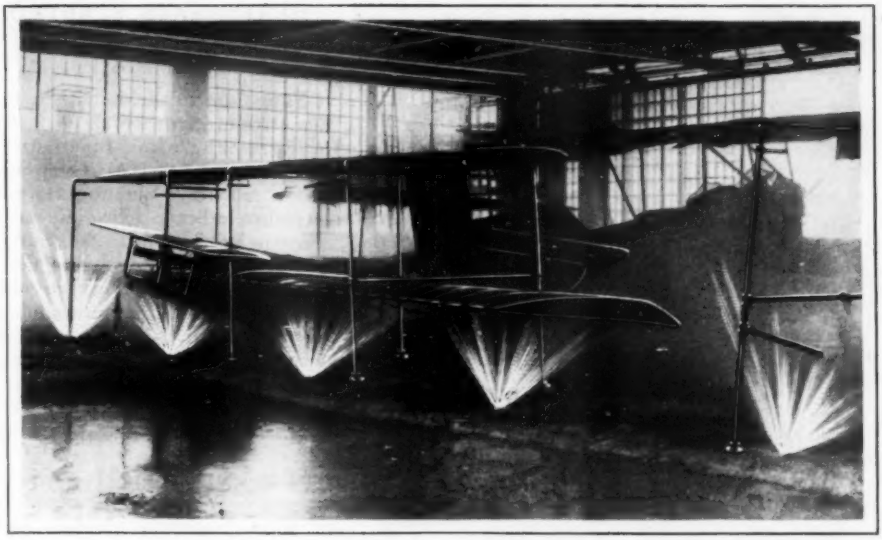
SOUND OCEAN FROM ZEPPELIN ON ARCTIC FLIGHT

Soundings of the water below and the air above, with automatic radio-equipped balloons, will be part of the program of scientific observation to be made by the dirigible "Graf Zeppelin" on its proposed flight over the arctic regions. The first ocean soundings to be made from a dirigible will be attempted as the ship sails over open lanes in the ice by means of the sonic depth finder. The instruments will be lowered to the water, and electrical connections between the float carrying the instruments and the dirigible will reveal the ocean's depth at any point. Aerial study will be made by ordinary sounding balloons equipped with automatic transmitters to report back to the Zeppelin the conditions encountered according to the instruments carried by the balloons.

HOMEMADE TELESCOPE BUILT OF AUTO AXLE AND IRON

Utilizing an old automobile axle and some galvanized sheet iron, a Pennsylvania student of astronomy has constructed a six-foot ten-inch reflecting telescope on a four-foot concrete base at a cost of $100. The telescope was designed from one of Isaac Newton's seventeenth century drawings and magnifies 288 times, making it possible to distinguish the hairs of a caterpillar on a church steeple three-quarters of a mile distant. The mirror is silverplated. Three months were required to build the instrument.

Homemade Telescope Constructed of Part of an Automobile Axle and Galvanized Sheet Iron



Hangar Equipped with Both Overhead and Ground Sprinklers for Protection of Planes; Heat Starts a Shower of Water from Above and Also Sends Powerful Sprays Upward

SPRINKLER SYSTEM IN HANGAR PROTECTS FROM FIRE

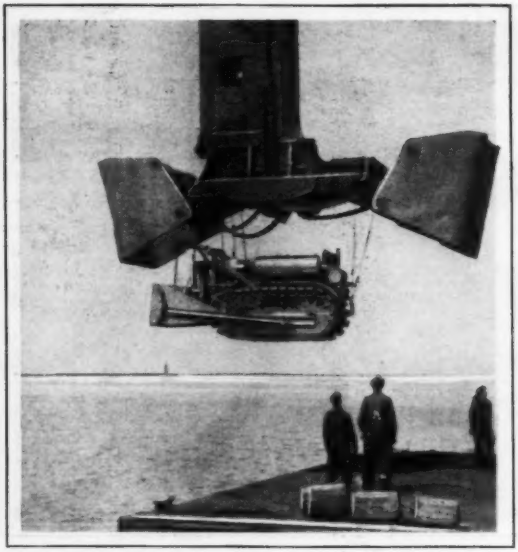
Complete fire protection is provided for the hangar and planes of the Colonial Airways at Newark, N. J., by an elaborate overhead-sprinkler system supplemented by a series of ground sprinklers. Heat from flames not only loosens the deluge of water from above, but also starts the ground sprinklers which throw water into the air from below. During recent tests, three planes were set afire in the hangar, and the flames were extinguished before any appreciable damage was done.

TRANSPARENT MAN LIKE GHOST SHOWS BONES AND ORGANS

Revealing every bone and organ of the human body in a state of perfect translucency, a transparent man on exhibition at a London health society has attracted much attention. The body was brought in sections from the museum of hygiene in Dresden. By a secret process the heart, skull, or any other organ or bone has been transformed into what appears a fragile, ghostlike model, crisscrossed by a delicate tracery of blue veins and red arteries. The basis of the process is the removal of every particle of opaque material, the flesh being turned into a transparent gelatine, after which veins and arteries are injected with plaster of paris, tinted blue or red. Similarly prepared bodies may be of aid to students of anatomy.

PAPER-BOX OPENER SAVES TIME IN UNPACKING CONTAINERS

Equipped with a removable blade somewhat like those used in safety razors, a paper-box opener now is available for opening any kind of container from a cereal package to a heavy corrugated packing case. The blade is adjustable for cutting boxes of various materials and is operated by slipping it into an edge of the box and running it along the surface. It safeguards the contents of the containers and makes possible their repeated use.



Power Shovel Lifting Tractor from Deck to Ship, Where It Pushed Ore within Reach of the Shovel's Jaws

POWER SHOVEL LIFTS TRACTOR FROM BARGE TO SHIP

Loading a large tractor from a barge to the hold of an ore ship recently was accomplished at Cleveland with the aid of a power shovel used to unload the ore. The tractor was attached to the shovel by cables, lifted from the barge and lowered into the hold. It was used to push ore to a point under the hatch where it could be picked up by the shovel.

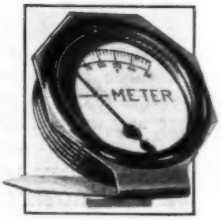
FOUR-WAY WHEEL WRENCH FITS ALL RIM NUTS

Simplifying the removal of wheels of either the old or new-model Fords, a four-way wrench now is on the market for service stations. The two sections of the wrench are set at right angles to afford leverage, and its various openings fit all rim nuts of the old Fords and the wheel nuts of the newer models.

HEARTBEATS STARTED BY RADIOACTIVE CHEMICAL

Potassium in the diet is the radioactive element which normally performs the vital function of starting the heartbeat, experiments at the University of Utrecht indicate. Earlier tests showed potassium to be radioactive, and the more recent ones have proved a radioactive element is essential in initiation of the heartbeat, and hence indispensable in the diet. Radioactivity of potassium is about one-millionth to one-hundred-millionths that of radium, but even this minute charge is essential in starting heart action. It also was discovered that such elements as uranium, polonium, thorium and radium may replace potassium in some of the simpler processes of cell activity, and tests are to be made to determine the pharmaceutical value of radioactive spring waters. Electrons from potassium atoms and their ionizing power apparently are the active agents.

THERMOMETER FOR ICE BOX PROTECTS FOOD



Measuring the proper temperature for refrigeration, a thermometer for the ice box now is on the market. It is slow-acting, which is particularly desirable for this purpose, and uses a dial marked in two colors, the danger scale from fifty to eighty degrees in red, and below fifty in black.

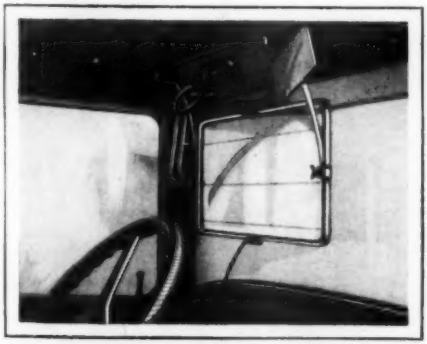
PUMPS DRAIN THE ZUYDER ZEE TO INCREASE FARMS

Pumps have been started in Holland which will drain 550,000 acres of the Zuyder Zee now covered by the sea, thus adding seven per cent to the total area of the

Netherlands and ten per cent to the country's arable soil at an estimated cost of $200,000,000. Borings to test the soil under the sea were made, and only the best sections are being drained so that it is estimated that only eight per cent of the land will be sand. After dikes have been built and the water pumped out, the land will lie fallow for some time until rains have washed out the sea salt, but meanwhile it will be available for grazing. Across the mouth of the Zuyder Zee, a dike nineteen miles long is being erected, 112 yards thick at its base, made of sand and stiff clay and buttressed with brushwood weighted with stone. On this dike will be laid a double railroad track, a road for heavy motor and wagon traffic, and one for cyclists and pedestrians.

FROSTING OF GLASS IS STOPPED BY ELECTRIC HEATER

Good driving visibility under winter's most adverse conditions has been made possible by the development of an electric windshield heater for the automobile. It consists of a shallow steel frame with a glass back, wired for connection to the battery. The frame fits air-tight against the windshield, and between the glass back of the heater and the windshield stretch three wires which keep the air between the panes of glass at a constant temperature of from seventy-eight to eighty degrees when the heater is operating. This heat melts snow, sleet and ice on the outside and keeps the glass back of the shield dry at all times.



Electric Windshield Heater Which Warms Glass Sufficiently to Melt Snow and Sleet

Globe of World Inside of Which Is Index and Gazetteer Containing over 200,000 Words

GLOBE OF WORLD HAS INDEX AND TINY GAZETTEER

Giving a combined index and gazetteer of approximately 200,000 words, a revolving globe of the world has been made by a Californian on the surface of which may be found 43,000 cities, towns, rivers, bays, mountains and other geographical features. The index and gazetteer is contained in a mechanism within the globe, the use of which makes it possible to locate many more positions than is possible with the ordinary globe. Outwardly, the appearance is much like that of any other globe, save that the surface is broken in two places for the insertion of magnifying lenses, through which the printing inside may be read. The paper is printed in a continuous roll and the type is microscopic, requiring a reading glass. Each strip in the globe, printed on a special press, is four inches wide and fifty-one feet long, containing twenty-eight lines of type to the inch. The strips are wound about a metal drum which is geared to a handle that turns the index-gazetteer to any desired name.

PHARAOH'S HEART

Courtesy Field Museum of Natural History

Dr. Ed. C. Jerman with X-Ray Outfit for Examining Mummies, and, at Right, Mummies of Boy and Girl

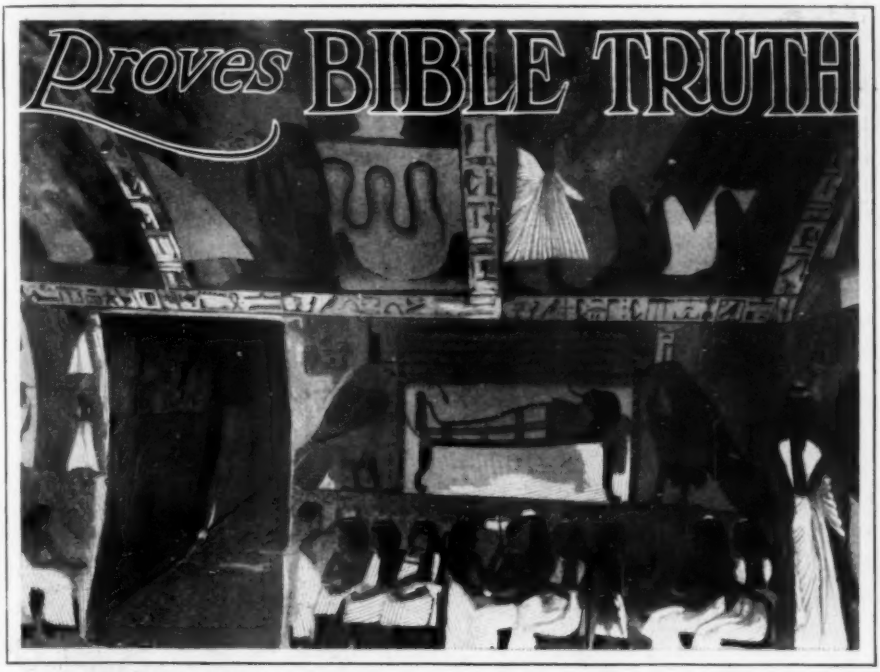
By HAROLD T. WILKINS

ONE night, about 4,000 years ago, in a range of lonely hills of western Thebes in the Nile valley, a band of robbers, hiding picks, axes and ropes under voluminous robes, were stealing across a hot and desolate waste of sand to the base of high cliffs of limestone.

Rounding a vast block of stone, which seemed to have fallen from above, but was a cunningly made screen, they saw a hole in the face of a cliff. They lowered themselves down a fifty-foot shaft, and groped their way in pitchy darkness along a tunnel, so low that they had to stoop to avoid hitting their heads against the roof. Now, they turned a corner, and descended a flight of rock-hewn steps deep into the bowels of the hill. They entered a vast hall where mummy cases were piled against the walls, and alabaster vases, ushabtiu statuettes and terra-cotta figures stood around. Along another corridor they went, and entered into the hall of dead pharaohs with gilded sarcophagi and mummy cases decorated with hieroglyphic pictures from the "Book of the Dead."

One of the intruders struck his ax at the swathed mummy of a king on whose linen shroud was written in hieratic characters the name "Meneptah." The ax cut right through the cloths from the chest to the spine. The robbers were impatient to strip the pharaoh of the gold, jewels, and precious stuffs and costly ivory and fur-

Proves BIBLE TRUTH



Courtesy Institut Francais d'Archeologie, Cairo

Interior of a Pharaoh's Tomb, Showing Mural Paintings Depicting Scenes from the Egyptian "Book of the Dead," Souls Being Judged or Awaiting Judgment in the After-World

niture buried when the priests hid the royal mummies in the Valley of the Kings. Collecting the plunder in feverish haste, they filed out quickly the way they came, lest dawn arrive or a chance watcher detect them at their work and inform the high priest or the descendants of the long-dead rulers.

Then the tomb was left to the mice, till, 4,000 years later, a famous French archæologist, Gaston Maspero, was asked by some Arabs if he would buy some beautifully illuminated papyri.

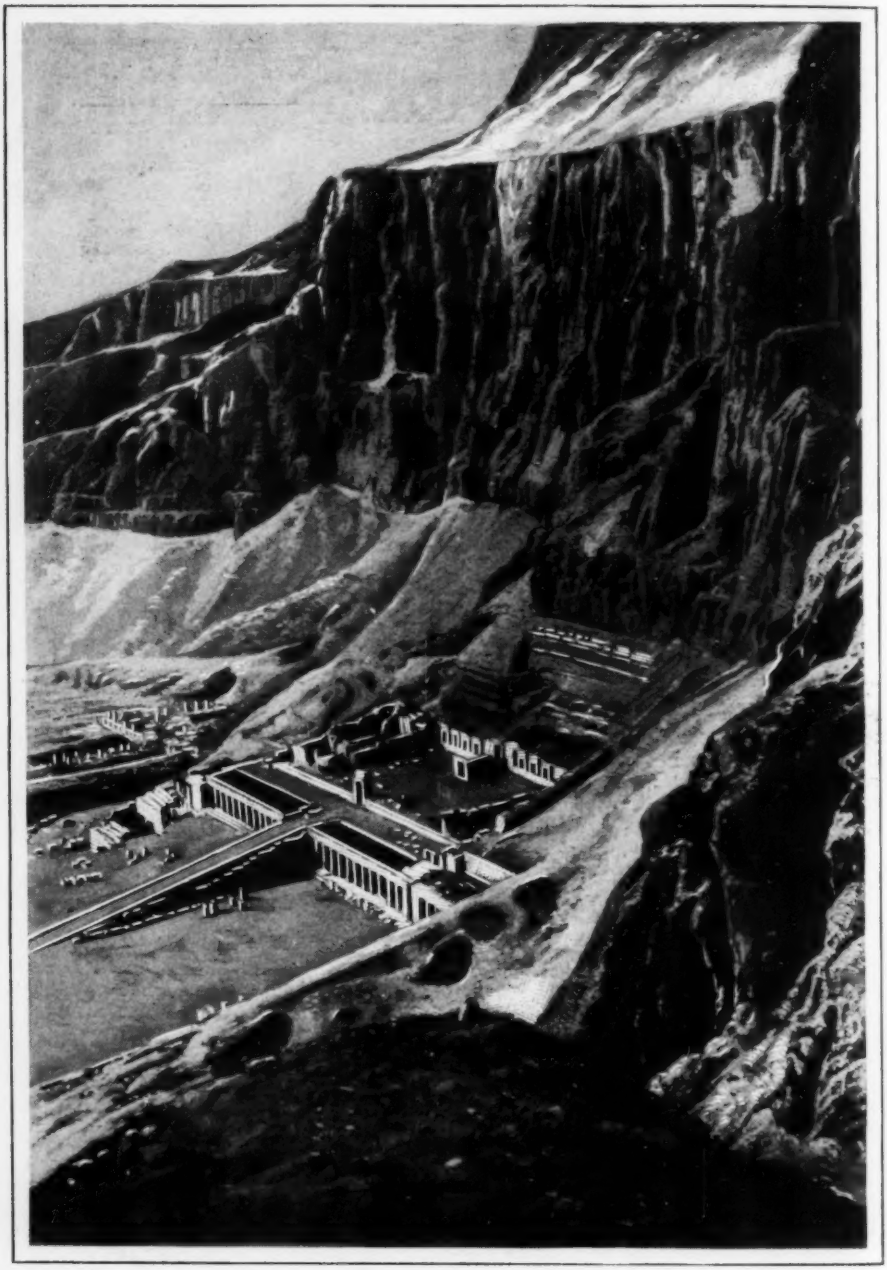
"Where did you get them?" he asked.

The Arabs were evasive. Maspero's mind flashed to the conclusion that they were in some way related to tomb robbers who had discovered a royal burial chamber. He told a pasha, who had one of the men arrested, but with no success. Bribery won, however, and the royal mummies were once more brought to the light of day after their sleep of 6,000 and more years.

It was found that one of the mummies was that of Pharaoh Meneptah, and it was recalled that a tradition among the Jews of Alexandria said that this was the Pharaoh of the Oppression who, with his host, was drowned in the Red Sea when the Israelites made their exodus from Egypt to the land of Goshen, somewhere in the peninsula of Sinai.

Professor Elliot-Smith, a famous medical scientist and ethnologist, was given the task of examining the mummies. "It is essential that we examine the mummy of Pharaoh Meneptah," he told Maspero, who replied, "Yes, we must invite the missionaries to be present at the unwrapping of it."

Professor Smith recently told the story of the unwrapping of Pharaoh Meneptah's mummy. "While I was removing the bandages, M. Maspero was busy telling the visitors of a tradition of the Alexandrian epoch that Meneptah was the Pharaoh of the Exodus who perished in the Red Sea. Hence, when the mummy was exposed, and I called attention to



Tomb of Queen Hatshepsut, the Female Pharaoh, at Deir el Bahri; This District Has Proved Rich in Archæological Treasures, the Mummies of Several Egyptian Kings Being Found near Here

the unique phenomenon of the incrustation of the body with crystals of common salt, M. Maspero at once turned to the missionaries and said: 'There you see the confirmation of the Red Sea episode.' And, when examining the body which ancient tomb robbers had hacked with an ax, I found calcified patches on the large vessel of the heart, M. Maspero at once added 'and you see his heart really was hardened.' One of the broken pieces of the damaged aorta M. Maspero allowed me to send to the late Professor Shattock of the Royal College of Surgeons.

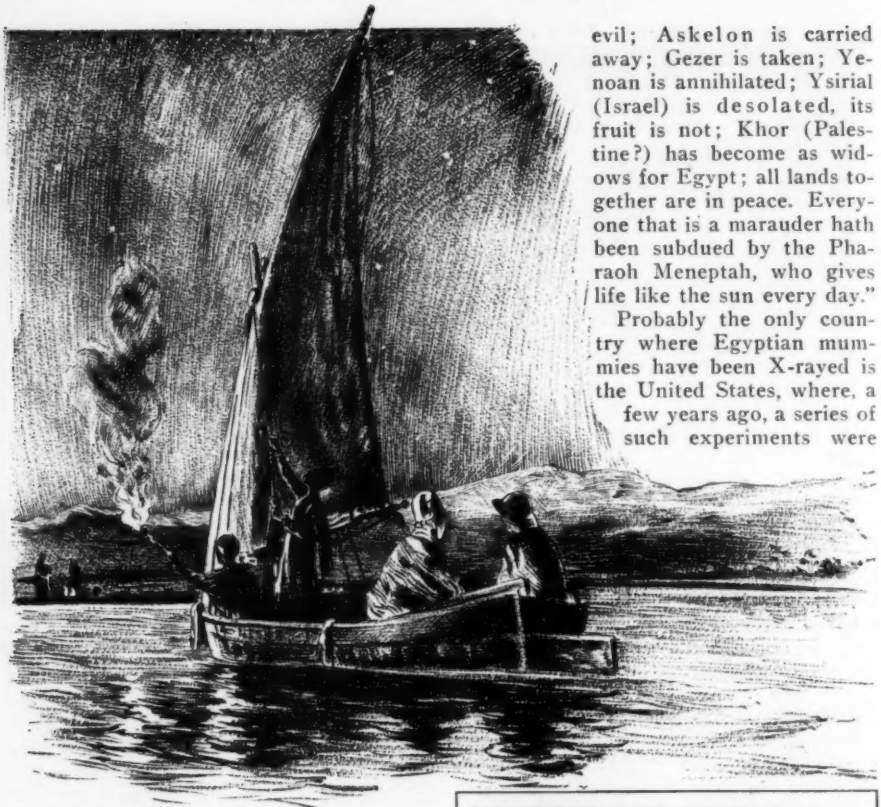
"The tomb robbers inflicted very severe injuries on the corpse. The hands were placed in the position of grasping scepters, the thumbs being in the position reproduced in the bas-reliefs. The skin of the body was thickly encrusted with salt, which my colleague, Mr. W. M. Colles, has examined and found to be sodium chloride (common salt). The mummy of this pharaoh has been cut by a tomb robber's ax, and the throat and body gashed. On the back of the head there is a hole made by a sharp instrument. Whether this was due to the tomb robbers' haste to remove the wrappings, or made for some occult reason (to allow evil spirits to escape, as Maspero suggested) is conjectural. The pharaoh was a man of great age. He had a prominent and high-bridged nose, and was rather corpulent."

Photo, Courtesy Sir Arthur Keith and Professor Elliot-Smith

Top and Bottom Photos, Courtesy Metropolitan Museum of Art

Sphinx of Queen Hatshepsut; Head of Pharaoh Meneptah, Who Suffered from Hardened Heart, and Empty Coffin Found in Tomb

Lord Moynihan, president of the Royal College of Surgeons, where the heart of the pharaoh was examined under a powerful microscope, declared: "We have ocular demonstration of the truth of the Old Testament words, 'And the Lord hardened the heart of Pharaoh, and he hearkened not unto them; as the Lord had spoken unto Moses.' His heart was really hardened. The large vessel springing from the heart was found in such well-preserved state that S. G. Shattock made sections of it and compared them with those made from a man recently dead. I have shown the two sections side by side on a lantern slide, and no pathologist can

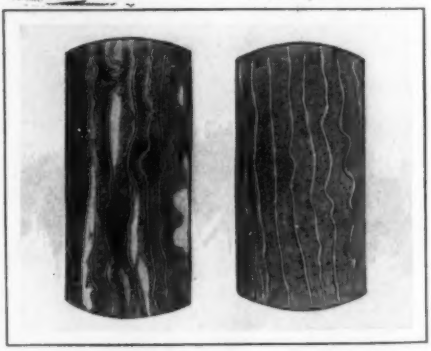


Sailing across the Nile at Night on a Visit to an Important Spot, Valley of the Kings

tell me which is the ancient and which the modern vessel. Both were attacked by the disease atheroma, a condition in which calcium salts are deposited in the walls of the vessel, making it rigid and inelastic. The vessel did not expand adequately to the stream of blood coming from the heart, so that this pharaoh suffered from high blood pressure." Meneptah left a stela with an inscription at Thebes, which was unearthed in 1896, and may refer to the Israelites:

"The villages are again settled. He who prepares his harvest will eat it. He is born for the purpose of avenging it—the King Meneptah. Chiefs are prostrate, saying 'Peace!' Not one of the nine bows (the barbarians) raises his head. Vanquished are the Tehennu (Libyans or desert marauders); the Khita (Hittites) are pacified; Canaan is prisoner in every evil; Askelon is carried away; Gezer is taken; Yenoan is annihilated; Ysirial (Israel) is desolated, its fruit is not; Khor (Palestine?) has become as widows for Egypt; all lands together are in peace. Everyone that is a marauder hath been subdued by the Pharaoh Meneptah, who gives life like the sun every day."

Probably the only country where Egyptian mummies have been X-rayed is the United States, where, a few years ago, a series of such experiments were conducted. It was found that ancient Egyptians suffered from some very modern diseases, including chronic rheumatism, tuberculosis of the bones, caries and pyorrhea, and appendicitis.



Courtesy Sir Arthur Keith

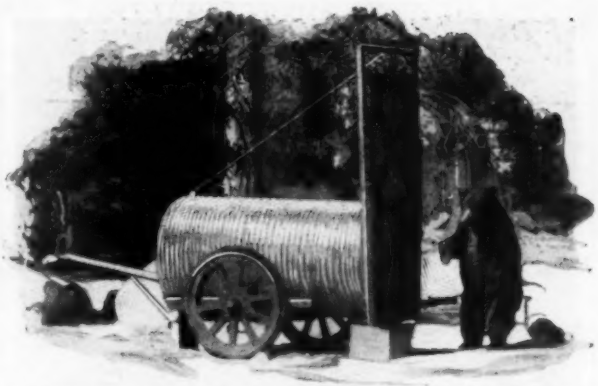
Magnified Section of Pharaoh's Heart, Left, Compared with Section of Same Organ of Modern Man, Both Showing Hardening

DEEPEST BUILDING IS PLANNED IN JAPAN

While other countries are contesting to build the world's tallest building, Japan is planning the world's deepest one, drawings having been made for constructing an underground "skyscraper," eighty stories deep at Tokyo. It is even planned so it can be made deeper from time to time as additional floor space is needed. The framework will be of steel, and the material will be concrete and stone. The building is to be cylindrical in form, 155 feet in diameter and 1,100 feet deep, with a ventilating shaft seventy-five feet in diameter running straight down through the center of the structure. It is to be equipped with modern conveniences, including electric lights, elevators, telephones, wireless and mirrors reflecting sunlight. It is estimated the building can be completed in less than one-third the time required to build a fifty-story skyscraper, and its cost is placed at about $12,000,000, only a fraction of the cost of a skyscraper as tall.

WIPER BLADE HAS TEN EDGES TO CLEAN WINDSHIELD

Worn blades of windshield wipers now may be replaced with a refill which fits any kind of wiper and may be attached in little more than a minute. The wiper is composed of a wedge-shaped piece of solid rubber, having along each side five separate edges of rubber which clean the glass without smearing or collecting mud or snow. An adapter is provided for wipers having a crooked arm.



Bad Bears in Yosemite National Park Are Trapped in This Tubelike "Patrol Wagon" as a Preliminary Step to Banishment

PATROL WAGON FOR BAD BEARS IN YOSEMITE PARK

Unruly bears in Yosemite national park have their own patrol wagon for a ride to the "station." It consists of a corrugated pipe, sealed at one end and equipped at the other with a trapdoor. It is mounted on pneumatic wheels and attached to a truck. When a bear causes trouble, out goes the patrol wagon. It is detached from its wheels and a piece of meat placed inside. When bruin goes after the meat, the trapdoor catches him. The sentence, if the bear is found in the inhabited portion of the park, is banishment. It is marked with a daub of paint, and apparently this causes the animal to feel disgraced, for it is said it rarely causes further trouble.

BRAIN GROWS TILL SIXTY

Belief that man's brain continues to grow until the age of sixty has been expressed in a report to the Brush Foundation for the Betterment of Human Stock. The report says it is doubtful if a part of the brain reaches its limits before sixty, but adds that the part which is the seat of imagination and originality shows its maximum growth between four and seven years. The part covering memory and experience begins to grow at seven years and continues until nineteen. Thereafter a part, called the silent area, shows possibilities of expansion in human beings alone until very late in life.

Solarium for Tubercular Patients in Hungary, Constructed Like a Roundhouse so It Catches the Sun's Rays from All Angles

SOLARIUM LIKE A ROUNDHOUSE CATCHES SUN'S RAYS

Resembling a roundhouse in construction and appearance, a combined solarium and fresh-air pavilion has been built for a tuberculosis sanitarium in Hungary. The center is glass-inclosed for protection from the elements.

HANDS RELATED TO TONGUE IN STUTTERING TEST

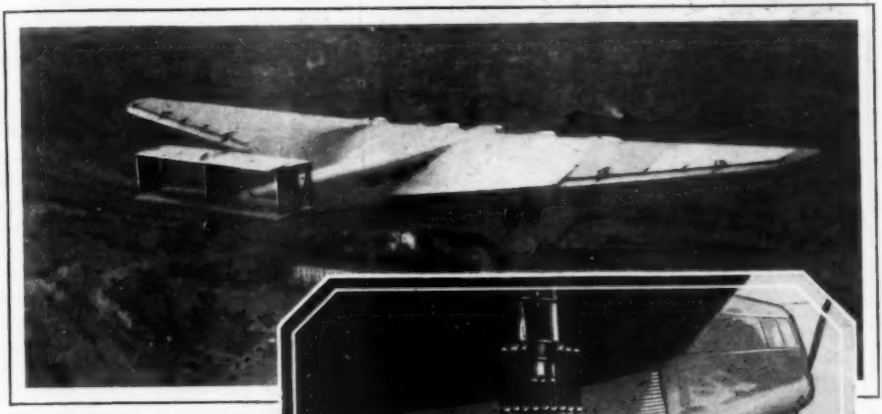
Use of the hands and stuttering have a definite relationship, tests by Dr. Milton Metfessel, psychologist of the University of Southern California, have shown. A person physiologically left-handed, that is, born naturally to use the left hand in preference to the right, but who has cultivated a habit of using the right hand, often stutters, he found. The mental workings of such a person are so disturbed by the unnatural right-handedness that stuttering is induced. Use of the hands as nature intended often remedies the condition, and tests to determine the hand naturally used are given by having the patient trace a star in a mirror with both hands. The hand that is the fastest is the one which should be used normally.

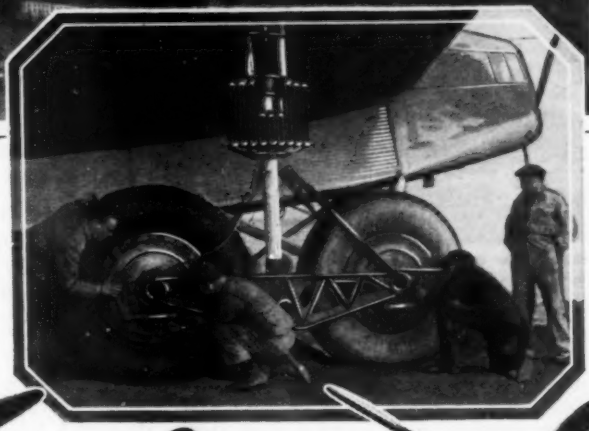
Tracing a Star with Both Hands Simultaneously, to Show if Patient Is Right or Left-Handed

FISH FIGHTS SPORT OF SIAMESE NATIVES

A strange sport using fighting fish is one of the features of Bangkok, Siam, where these fish are bred specially for this purpose. A pair of males are taken to a hall and placed in a glass globe, while crowds gather round to watch the fish fight until one kills the other. The crowd shows as much excitement as the spectators at a boxing ring in America or Europe. Many bets are made on the fights, as they are in progress. The fish change color while the fight is going on. When they close at the beginning, their bodies take on a bright-pink hue, changing to intense purple, green and blue tints as the fight goes on. The fish are only two or three inches long, but are fierce fighters, and in zoos have to be separated in the tanks by thick sheets of plate glass, to prevent them from tearing each other to pieces. The Siamese greatly prize these fish, and will wager all they possess on a fish of good fighting qualities. So fierce are the fights, that the winner is seldom able to fight again. It is used, however, for the purpose of breeding.

HUGE LAND PLANE CARRIES PASSENGERS IN WINGS





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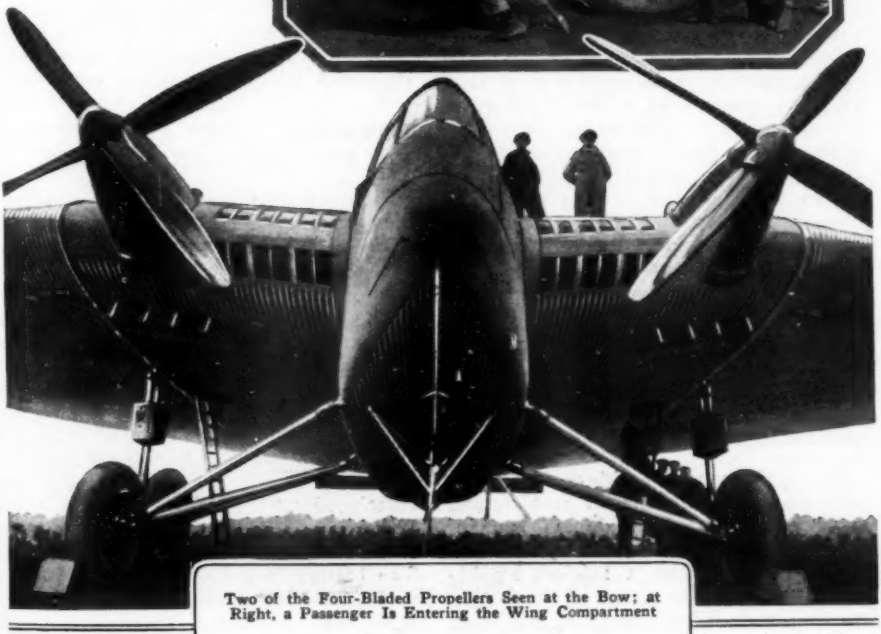
The Junkers Plane "G-38" in Flight, and a Close View of the Landing Wheels, Which Are Five Feet in Diameter; the Ship Has Four Motors, Developing a Total of 2,400 Horsepower, and Carries Forty Persons



Two of the Four-Bladed Propellers Seen at the Bow; at Right, a Passenger Is Entering the Wing Compartment

Vacuum Gear Shift for Auto Is Operated by a Throttle on the Wheel Instead of by a Lever

VACUUM GEAR SHIFT FOR AUTO ELIMINATES LEVER

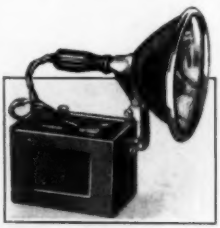
. Eliminating the gear-shift lever, and substituting finger control from the wheel of the automobile, a vacuum gear shift has been invented by a New York automotive engineer. The device makes use of the engine intake to create the necessary vacuum and may be installed on any car by removing the cover plate of the transmission box and applying a special one. An attachment is made to vacuum tubing running to two small cylinders at the rear of the transmission case, and a line extends to the motor intake pipe. The shift is operated by a throttle on the steering wheel.

RIFLE AND TOY BALLOON SOLVE ENGINEERING PROBLEM

How a sharpshooter with an idea and a toy balloon solved a difficult problem and saved several thousand dollars was related at an engineering society meeting. Due to an oversight, a 125-foot smokestack for one of the plants of the Southern California Edison company had been erected without the usual built-in steel ladders on the outside, and when it became necessary to get at the top for repairs, the workmen found they would have to sprout wings or else build an expensive scaffolding to the top. Finally, the foreman of an "outside" construction gang of the Consolidated Steel corporation, whose plant adjoined that of the utility company, was called in consultation and hit upon a plan which, so far as engineering records show, is unique. Obtaining a rifle, he inflated a toy balloon to about four feet in diameter, attached a light string to it and staged a take-off inside the high stack. Taking his stand some distance from the chimney, he waited until the balloon floated high above the stack and then brought it down with a well-aimed shot from his rifle. The position from which he shot was on the side of the chimney so that the balloon and string would fall outside the stack. To the string was attached a stout twine and when that had been hauled over the side, a rope was tied to the twine and pulled up. A cradle attached to the rope then took a repairman to the top.

PORTABLE LIGHT AND BATTERY FOR EMERGENCY WORK

Providing 300,000 candlepower, and capable of projecting a beam one mile, a portable electric searchlight, weighing only thirteen pounds, is now available for emergency work at night on overhead high-tension lines, in manholes or other dangerous positions where sufficient light is essential to safety. Both beam and floodlight will burn from two and one-half to three and one-half hours. The battery is provided with an adjustable light bracket and the flood type of light will brilliantly illuminate 30,000 square feet at a distance of fifty feet.



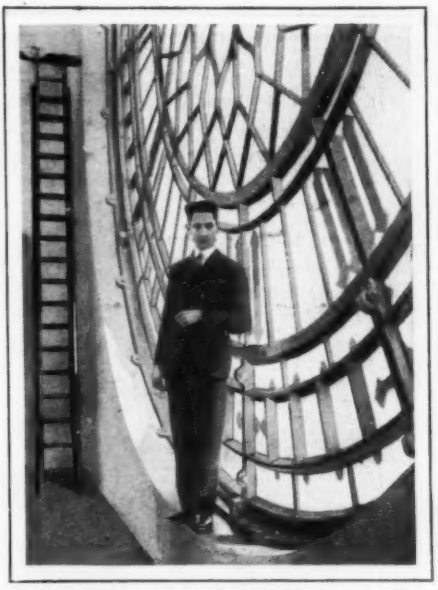
FEWER PERSONS RIDE ON TRAIN EACH SUCCESSIVE YEAR

Passenger business of the railroads, which has been dropping since 1920, still is on the decline, although the loss of 1929 was less than for any year since 1920, except 1925. All the loss occurred in day-coach business. Loss for the first eight months of 1929 was about one per cent as compared with six per cent in 1928, and passenger business was about thirty-four per cent less than in 1920. Part of the decline in passenger earnings, the smallest since 1917, is attributed to a slow but steady decline in the average passenger rate in addition to the decline in traffic.

PHONOGRAPH IN AN END TABLE CONNECTS TO RADIO

Inclosed in an end-table cabinet, an electric phonograph, which may be connected to any radio receiver amplifier having a phonograph pick-up jack and played through the radio loud speaker, now is on the market. The cabinet has a compartment for records and may be placed beside a chair a considerable distance from the radio, the cabinet top forming a convenient table for books or other living-room accessories, when the phonograph is not in use.

Phonograph Built into an End Table Intended for Connection with Electric Radio



Close-Up of Part of One Dial of Big Ben, in Westminster, with Figure of Man for Comparison

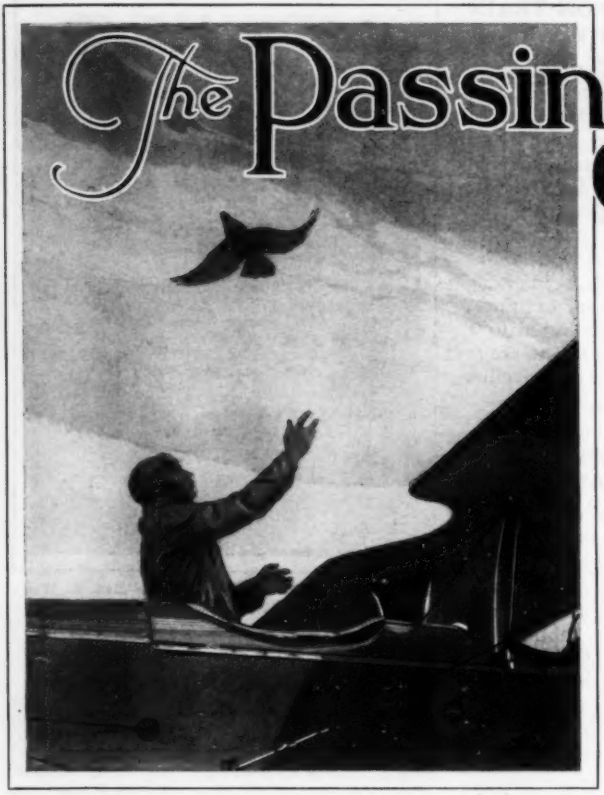
MAN DWARFED BY GIANT DIAL OF WESTMINSTER CLOCK

Mere man is dwarfed in comparison with the giant dials of the most famous, and probably one of the most authoritative clocks in the world, "Big Ben," whose sonorous chimes sound hourly from the tower in Westminster, London. The figures on each of the four faces are two feet high and the minute hands are fourteen feet long.

HOG BRISTLES IN GOLF BALLS REPLACE RUBBER WINDING

Golf balls that depend on springy hog bristles for life instead of all-rubber cores, have been developed recently. Instead of the ordinary center of rubber bands wound over a core, a homogeneous mass of rubber and bristles is used, the standard cover being applied over it. Tests show the ball to be as lively as any other type, the bristles acting as tiny individual springs when the ball is struck. The mass of rubber and bristles does not change shape easily, and balls of this type can be produced much more cheaply than the wound type.

The Passing of the



Aviator Demonstrating the Proper Method of Tossing a Carrier Pigeon, Bearing an Important Message, from a Speeding Airplane

By JAMES NEVIN MILLER

THE SWAN song of the carrier pigeon, internationally famous since the days of ancient Greece for bearing important war-time messages, has just been sung by the U. S. navy.

Advanced developments in aircraft radio have eliminated the bird's value as a messenger, according to official orders, with the result that eight of the ten lofts, maintained by the navy throughout American territory, will be abolished. Only lofts at Lakehurst, N. J., and Guam will be kept, and the number of birds retained, 400, is about half that used up to the present time.

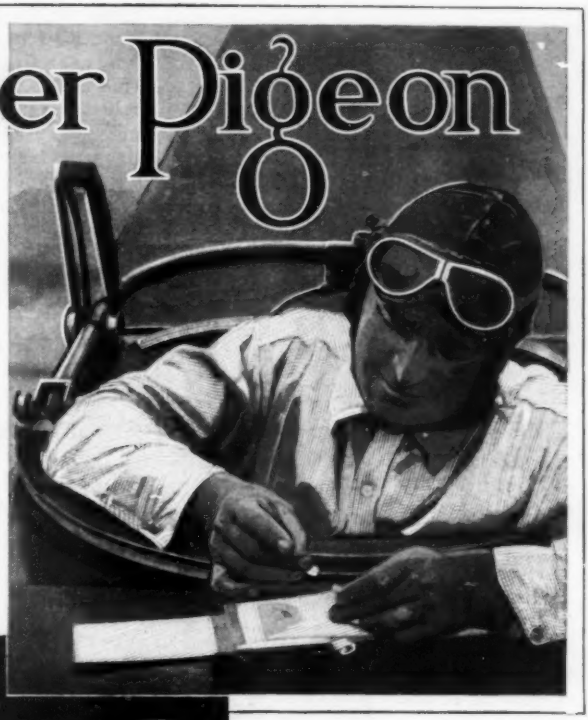
"The greatest pal the fighting Yankee doughboy ever had," is the way the World War buddies like to speak of the carrier. That this affectionately phrased opinion isn't far from the truth is indicated by the fact that the official records of the pigeon's valor are almost innumerable. Indeed, they form a chapter of the war that has never received due recognition.

Probably history has no record to compare with that achieved by the dauntless "Spike." Pigeon fanciers are still telling his story. Of uncertain pedigree and bred by American troops in France, he was a strong, aggressive, fast-flying bird with considerable vitality and unusual endurance. He is known to have delivered fifty-two messages all told without receiving the slightest injury.

Another famous war bird was "Cher Ami." He delivered twelve important messages from the Verdun front to his loft at Rampont, a distance of forty kilometers, in the remarkable time of forty-five minutes. Upon his return from the last trip it was found that one of his legs had been shot away and his breast pierced by a bullet. The message tube, containing the important message, was found intact, hanging by the ligaments of the torn leg. This valiant bird earned a place among the immortals, for when he died, in 1919, he was stuffed and mounted in the famous Smithsonian Institution.

Then there was "The Mocker." A dark-red bird, of doubtful breeding, his best-known feat took place early on the morn-

Carrier Pigeon



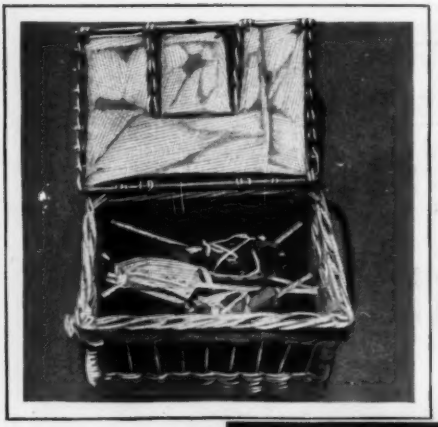
ing of Sept. 12, 1918. With one eye destroyed by a shell splinter, this game fellow raced home in splendid time from the vicinity of Beaumont front, St. Mihiel sector, bearing a message of great importance. Not only did the information thus sent give the location of certain heavy enemy batteries, but it enabled the Yank artillery to silence the rival guns within twenty minutes.

The pigeon section of the signal corps, U. S. army, had no existence prior to the entrance of the United States into the World War, and while many efforts were made previous to this time by interested observers to introduce carriers into the army, their value was not realized until after their performances had been observed in the European armies. Early in the war, the other countries had come to look upon the messenger pigeon as an important communication resort. When every other mode of contact had failed, the message was entrusted to a bird; and the fact that ninety per cent of these messages reached their destination after passing through every handicap imposed by battle conditions and unfair weather, will testify to the efficiency of pigeon liaison.

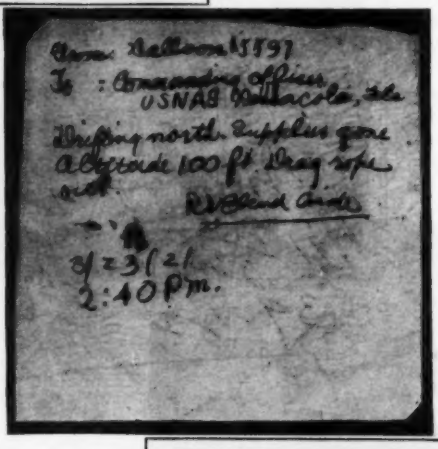
Top, Aviator Writing Message to Be Sent by Carrier Pigeon; Veteran of World War Which Carried Message Enabling Destruction of Enemy Battery after Being Wounded

Germany had a very efficient and well-established pigeon service. It is a matter of record that they had established, throughout England, lofts which were used for intercommunication purposes. This was made possible by maintaining flights between England and Germany before the war. Birds thus trained were simply held for release after hostilities had begun.

The commanding officer of the American expeditionary forces observed the wonderful work of the French and British



birds and appreciated the necessity for a similar service within our forces. It was therefore upon his recommendation that the section was authorized in November, 1917, by the adjutant general of the army.

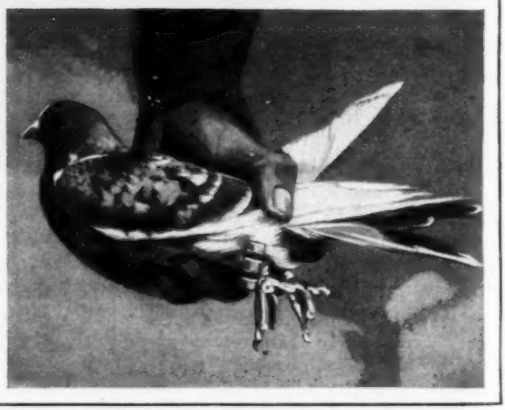


Immediate steps were taken to procure personnel and birds. When it is considered that homing pigeons bear the same relation to ordinary pigeons that a carefully bred, high-strung racing horse does to a drayhorse, it will be appreciated that the care and training of the messenger bird require considerable knowledge and experience. The physical condition of the bird is all-important, and a homer, no matter how carefully bred, must have a course of training before it will function efficiently.

The first extensive use of the birds by American troops in battle was made during the renowned Aisne-Marne offensive. Owing to the rapid advance of our forces and the constantly changing front line, difficulty was experienced in settling the birds, but a mobile loft, operating near the line, received seventy-eight important messages and 148 test messages in the active period extending from August 29 to September 11. Of the seventy-two birds used from this loft, not one failed to return.

In the St. Mihiel drive which followed, 567 carriers were available for the use of the American forces. Many of these birds were assigned to the tanks, and although their training had been very brief and prevailing fog and rain made flying difficult, ninety important messages were received, and of the 202 birds used in the tanks, only twenty-four were lost or killed in action. Moreover, most of these losses were caused by long detention in small assault baskets and by inexperienced handling.

How the messenger pigeon is equipped by nature to perform its marvelous feats is described thus graphically in an official document of the navy: "The modern homing pigeon is capable of



Top, Interior View of Pigeon Basket Carried by Doughboys; Center, Typical Message Sent by Pigeon; Below, Proper Way to Hold Bird in Attaching Message

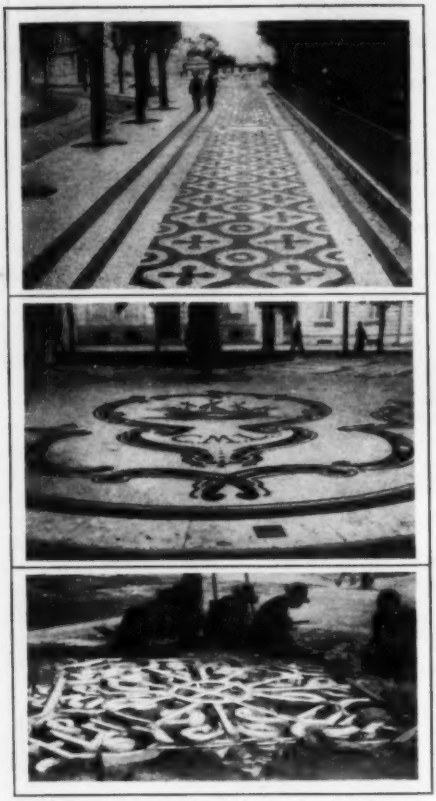
Soldier Carrying Homing Pigeons on Scouting Trip to Send Back Messages; Upper Right, Two War-Time Types of Mobile Pigeon Lofts; Below, Method of Attaching Aluminum Message Container

covering distances of 500 or 600 miles in a single day. The eye has great penetration of sight. The respiratory channels are wonderful, enabling a pigeon to fly without interruption for twelve to fifteen hours.

The ear appears to play an essential part in the sense of direction. It includes three semicircular canals, which appear to be the nerve conductors of orientation, and it is probable that their great sensitiveness enables the pigeons to perceive magnetic and other atmospheric disturbances, as experience has shown that any lesion of the canals destroys the sense of direction.

While the use of pigeons as a means of aircraft communication with the ground forces was utilized during the World War, it was really only an experiment. Since the war, however, it has become a genuine science. Night flying, for instance, has been utilized to a remarkable degree. A striking case in point took place a couple of years ago. It seems that, around midnight, the launch "Crow," of the Panama canal department, with eleven persons aboard, left Balboa Heights for a trip to the Pearl islands. Eight pigeons were taken along, four day flyers and four night carriers. After a slight mishap, the trip to the islands was accomplished, but it was deemed advisable not to return at once. After a couple of days, however, the vessel started back. Very soon it became apparent that little headway could be made against a heavy sea and terrific wind. Whereupon two day birds were released with a message asking for a boat to be sent to tow the disabled craft to safety. No help came, so another message was dispatched at night. The following day, just as the craft, now completely disabled, was in bad straits against the tide, an airplane circled overhead and soon returned with a rescue launch.

MOSAIC SIDEWALKS IN LISBON PORTRAY HISTORIC EVENTS



Sidewalks of Lisbon, Portugal, Laid in Intricate Mosaic Designs Depicting Local Legends

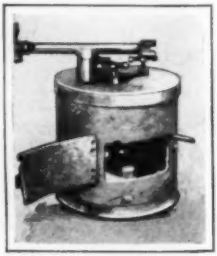
Probably the most unusual and most beautiful sidewalks in the world are found in Lisbon, Portugal, where skilled artisans lay the pavements in intricate mosaic designs, making the walks as decorative and costly as the floors of many great buildings. Some of the pavements represent historic episodes and local legends, and their construction takes much time.

AUTO BODY USED AS RADIATOR IN MIGHTY RACING CAR

Using the body surface as a radiator, a racing car of novel design has been built for Kaye Don, British driver, and is to be brought to Daytona Beach to attack the world's speed record of 231 miles per hour made there by Sir Henry Seagrave. The body of the car is made up of two layers of thin metal between which cool water circulates, and the space between the wheels also has been inclosed by two layers of aluminum for circulating water. The auto, fitted with two engines of 2,000 horsepower each, has many safety features. For instance, if it should enter the sea, the shape of the bottom would enable it to skip over the surface for a considerable distance, or if the wheels should collapse, it would slide along the beach without overturning. In order to avoid jarring the driver from his seat, it is mounted on a pivot and counterbalanced by a weight equal to the driver's. The car was actually built to Mr. Don's body measurements. It weighs two and one-half tons, is only two and one-half feet wide, has a fifteen-foot wheelbase and an over-all height of three and one-half feet, allowing a little less than eight inches of ground clearance. In the engines, supercharged and mounted in tandem, nitralloy-steel cylinder liners have been used to increase the horsepower due to the glass-like surface of the metal. The drive is taken through a three-speed gear box, then by a separate propeller shaft to each rear wheel, duplication of propeller shafts allowing a much lower position for the driver, thus reducing head resistance.

HEATER FOR AIRPLANE MOTOR FACILITATES STARTING

Enlisted men of the army air corps at Selfridge flying field have developed a heater for airplane motors to facilitate starting in cold weather. It consists of a coil of copper tubing heated by a set of three gasoline burners sheltered in a container small enough to fit into the cowling of a plane beneath the motor. Gasoline is drawn from the ship's tank, and the coil is hooked to the cooling system. The heaters are connected so that the water of the cooling system may be



directed through them or run through the usual piping. Ships standing outdoors in temperatures fifteen degrees below zero have been started as easily as during the summer months when the heaters have been allowed to run overnight.

EARPHONES FOR TABERNACLE ENABLE DEAF TO HEAR

Mormons who are hard of hearing now have no difficulty in listening to the speakers in the famous Salt Lake tabernacle, the benches of which have been equipped with earphones. Wires connected to an amplifier are strung beneath the benches and a plug attached to the phones fits into a jack beneath the seat.

TELEVISION FOR MANY MADE POSSIBLE BY MIRROR

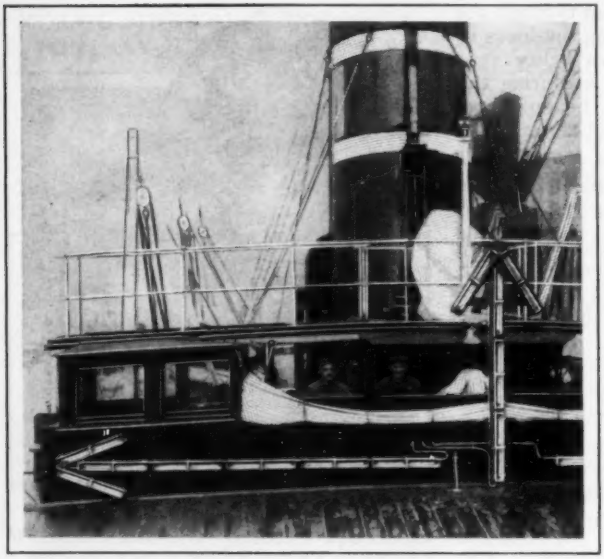
Television for groups of persons is made possible by an invention of Dr. Vladimir Zworykin, research engineer of the Westinghouse Electric and Manufacturing company, who has developed a cathode-ray set. The effect is accomplished by projecting the images onto a mirror visible to the spectators.

Television Receiver Which Throws Pictures on Mirror So Many May See, and Cathode-Ray Tube Which Casts the Image

Cotton Picker Moved and Operated by One Man, and Close-Up of Picker Head

COTTON PICKER CLEANS FLUFF AND SAVES TIME

One man is able to move and operate a light and compact cotton picker now on the market. The machine weighs 300 pounds, is two feet wide, five and one-half feet long and four and one-half feet high, rolling on three wheels between the rows, and has a three-fourth horsepower gasoline engine. A picker head, worn like a glove, fits in the operator's hand and he reaches for the boll as though picking by hand. The picker head lifts the cotton from the boll, wipers fluffing out every lock, after which air currents convey it through a long tube and direct it against a wire screen, thus separating sand, dirt, moisture and other foreign matter. It is claimed the picker operates in damp weather when picking by hand is impossible, picks cleaner than is possible by hand, thus insuring a higher grade, and operates on about a gallon of gasoline daily. The engine is used to provide suction and actuate the parts of the picker head.



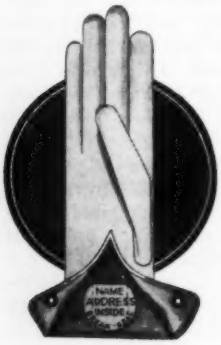
Electrically Illuminated Arrow on Dutch Ship Decreases Accidents by Pointing the Directions for Ships in Passing

ILLUMINATED ARROW ON SHIP DIRECTS OTHER VESSELS

To prevent collisions at sea, an electrically illuminated arrow has been installed across the bridge of the "Batavia V," a Dutch liner. The arrow is lighted to point the direction other vessels should take in passing.

NAME AND ADDRESS IN GLOVES FOR IDENTIFICATION

Identification tags for gloves, particularly helpful in case of accident or if the gloves are lost, now are being provided. The tag is glued to the inside of the wrist of the glove and the name and address are written on a small card which is placed inside a tiny envelope and sealed. The envelope contains instructions to break the seal in order to find the identification of the owner inside.



LACE DESIGNS ARE REPRODUCED IN RUBBER

Rubber lace, crochet work and tatting, almost identical with the originals, have been produced by a process evolved by an Akron inventor. First a mold is made by placing the article to be reproduced in contact with a hard rubber plate which is softened by heat, and then pressing the object into the surface. When the rubber hardens again, a durable impression of the pattern is left and duplicates are made by forcing rubber into the mold and curing it. The most intricate of expensive lace can be reproduced, the pieces being suitable for placing beneath flowerpots. Color combinations are also possible, and the pieces can be made either solid or with open meshes.

STEEL TOE CAP FOR SKATERS AIDS HOCKEY PLAYERS

Designed especially for hockey players, a steel cap attached to the skate, fits over the toe of the wearer's shoes, protecting him from the hardest blows. They are said also to assist in controlling the movements of the feet. The units are light in weight and permit wearing flexible, comfortable shoes.

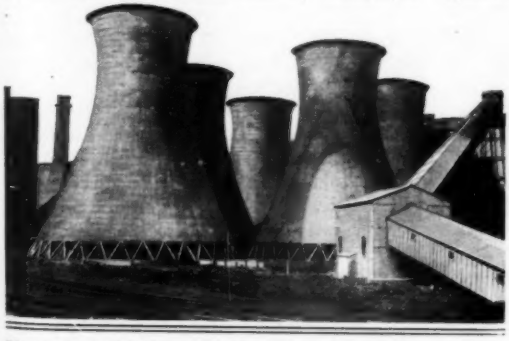
¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

WINDOW VENTILATOR-MUFFLER KEEPS OUT NOISE

Admitting fresh air, but keeping out street noises, a window ventilator which also serves as a noise muffler now is on the market. The muffler operates on the principle of the reflection of sound waves. Street sounds impinge on the outer member of the muffler and are reflected away from it. Some sound waves entering by reflection from masonry surrounding the window are caught by the inner reflector, and sound that otherwise would enter through the space between the sashes is kept out by a top barrier completely closing the gap between upper and lower sash. The result is that most of the noise that would enter through the opened window is kept out, although some noise enters by way of the glass when the window is closed, but this is deadened. The combination of reflectors with the sash between produces a valve used to regulate the air supply, and the shape of the inner reflector is such as to deflect air currents up into the room, thus preventing drafts.

POWER PLANT COOLING TOWER LIKE BIG MILK BOTTLE

Gigantic concrete cooling towers of the electric generating station at Liverpool, England, are a source of interest and wonder to all who see them for the first time. The huge towers, with their flaring bases, resemble nothing so much as the upper half of big milk bottles, or the straw-netted tops of cordial containers. They tower high above the near-by buildings.



They Look Like Huge Milk Bottles, but These Concrete Structures Are Cooling Towers for an Electric Generating Station

Theater Seat Equipped with Earphones to Enable Deaf Persons to Hear Talking Movies

DEAF PERSONS HEAR "TALKIES" THROUGH SETS ON SEATS

To enable persons hard of hearing to understand the "talkies," a western theater manager has equipped the seats with special acoustic receivers. The listener plugs into one of the units and is able to hear the sound which is picked up by a microphone device near the loud speakers and relayed to all the receivers.

HOW TO LOOK AT SPOTS ON SUN

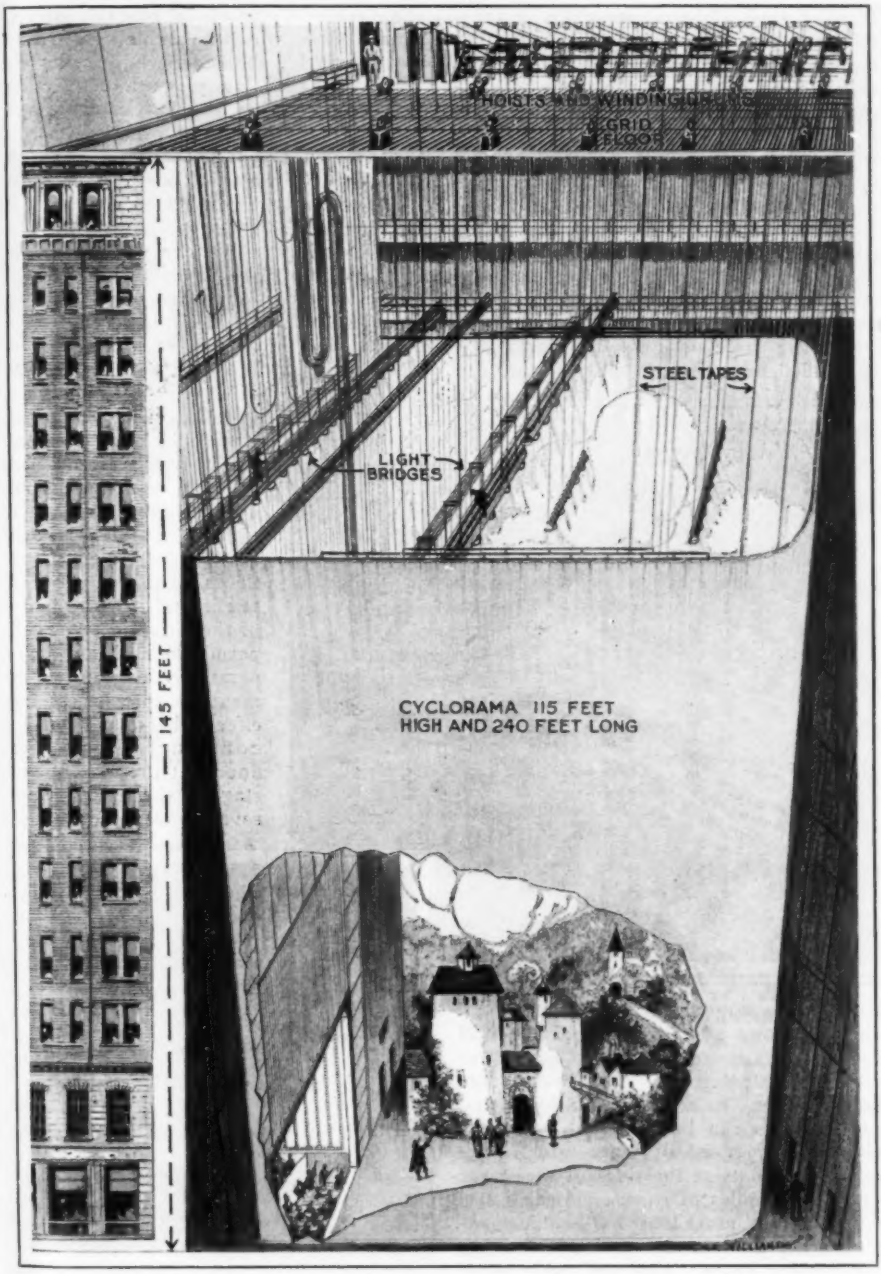
Smoked glass, the old standby for sun gazers and those desiring to see eclipses and spots on the sun, is not as effective for this purpose as spoiled photographic negatives because it is difficult to smoke the glass densely enough. Two overexposed negatives, placed one over the other, form an excellent shield through which to observe the spots. The film should be held close to the eye or close to the outer lens of binoculars. Look with one eye at a time to check against possible errors. Seeing a spot twice in the same place is evidence that the spot is on the sun, and not "in the eye."

The Magic Wand of the Opera

ACHIEVEMENTS of this age of science lend a fresh enchantment to Chicago's new Civic Opera, the stage of which is the largest in America and the highest in the world. It could swallow a fourteen-story skyscraper and have a few feet to spare! This tremendous height as well as several other amazing features of the theater, innovations never introduced before in any playhouse, enable the staging of grand opera on new levels of mechanical and artistic perfection.

For the first time in theatrical history, the men who run the lights have left backstage and take their place alongside the prompter in front of the curtain. For the first time, too, it is possible to effect instantaneous changes of lighting for entire scenes. Huge switchboards have been eliminated and in their stead there is a compact control set, as wonderful as Aladdin's lamp, for, at a touch of the hand, as much as 1,700 horsepower in the form of light can be made to produce sunsets, sudden thunderstorms and complex lighting combinations for the entire stage, all as simply and easily as the turning of a switch at home.

In the lofty wonderland behind the fifteen-ton steel curtain are other marvels.



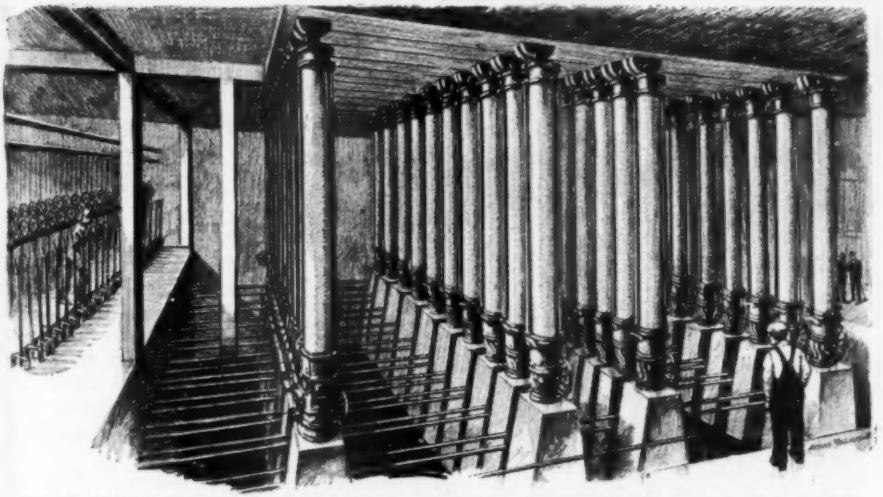
Artist's Drawing of the Lofty Wonderland Backstage in the Chicago Civic Opera House; the Space Is High Enough to Hold a Fourteen-Story Skyscraper

Slender steel ribbons, razorlike in thinness and only two inches wide but capable of supporting four tons, replace heavy cable to lift and lower the huge cycloramas, the big curved curtain drops, 240 feet long and 115 feet high, that embrace three sides of the stage. This steel tape is a story in itself. Opera-company craftsmen and engineers developed it chiefly to save space in the lifting machinery room high above the stage. It winds up on narrow spools when the cycloramas are raised or lowered, whereas wide drums would have been necessary for the cables. There are three of these cycloramas, all controlled from the central station at the right of the stage. Incidentally, the linen cloth for one of them cost $7,000, and forty artists were employed simultaneously in painting it. With these huge backgrounds, interesting outdoor and other effects can be produced, and they eliminate the need of "tormentors," the curtains or flats at the sides of the stage.

Over 100 miles of rope, steel cable and steel tape and more than 100 hoisting machines are used in shifting and lowering the various drops, lights and other paraphernalia of the stage. Over half of this equipment is controlled from another of the theater's marvels, a portable aluminum station which the chief electrician wears over his shoulders while scenes are being shifted. He plugs a connecting wire into a socket, touches a button and a bunch light, floodlight, or one or all of the three huge light bridges, each of which carries 24,000 watts of current for spotlights and arcs, move up or down at his discretion.

The working stage, the portion visible from in front of the footlights, is divided into twenty sections, each of which may be raised twelve feet or lowered twelve feet or tilted in either direction at an angle of thirty-five degrees. This is accomplished by forty plungers, two for each section or trap. They are operated by hydraulic rams and are run from the central control station at the right of the stage. Each section has roll-away floors. This feature and the lift and drop flexibility of the different traps will permit the rapid and comparatively easy arrangement of complex scenic effects that could not be constructed on a flat floor. At the rear of the stage is the largest trap, seventy-five feet long and

Views of the Light-Control Boards and the Portable Station for Raising and Lowering Stage Units



Drawing of the Forty Hydraulic Plungers That Raise or Lower the Twenty Stage Sections Above a Total Distance of Twenty-Four Feet to Make Possible Varied Setting Effects

five feet wide. It rises five feet above the level and descends thirty-five feet into a huge moisture-proof vault, where 2,000 drop curtains, all lettered and filed away according to the operas to which they belong, are stored. Drops for from three to ten operas may be hung at one time on the 106 scenery "pipes," each of which is seventy feet long and has a clear lift of 144 feet.

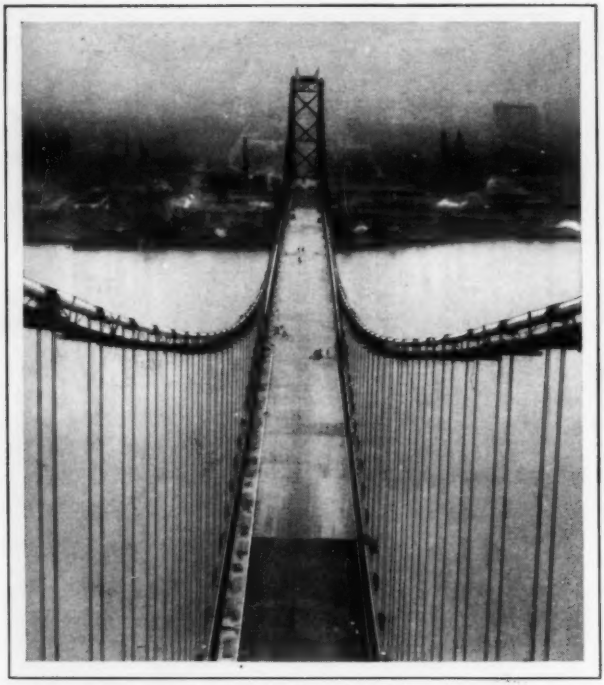
Back of the proscenium is a steam curtain for scenic effects and two fast-working curtains operated by horizontal hydraulic machinery, one for the drape curtain and the other for the act curtain. Both are controlled from the right side of the stage. In the pit is equipment for an orchestra of 200 pieces. The pipe-organ console is portable, so that it can be placed at different locations in the pit or on the stage. While the conductor is directing the orchestra, he can talk to persons backstage through a microphone connected to a loud speaker. To relay the time of the music to an off-stage group of singers or a band, it is no longer necessary for an assistant conductor to peer through a peephole and pick up the beat from the conductor. The assistant has a time beater which operates from a keyboard of four keys and controls four lights backstage.

All the lighting circuits are grouped under the control of master knobs. In operation, the lighting supervisor may set in advance the illumination for a scene, and when the time comes for the performance, he cuts it into the circuit by means of a master switch. From his booth next to the prompter's, the lighting director is able to see all the lighting on the stage and also in the auditorium, although he is not visible from the audience.

At the rear of the theater is the radio room where opera performances will be broadcast with the latest equipment. The entire theater is provided with specially conditioned air so that even temperatures and humidity may be maintained, regardless of the weather outdoors. The opera house is constructed within a huge building which also contains a smaller "studio" theater adjoining the main auditorium.

IMPROVED AIRPORT MAP

Location of the principal airports in large cities and a pictorial diagram of each landing field are shown on a condensed map that takes up but little space and can easily be interpreted by the pilot. It saves turning pages or handling a large chart. The diagrams of the fields give the position of runways, hangars, lights and obstructions as well as other information important to the flyer.



The 1,850-Foot Free Span of the "Good Will" Bridge between Canada and the United States, the World's Longest Suspension Span

"GOOD WILL" BRIDGE TO CANADA HAS LONGEST SPAN

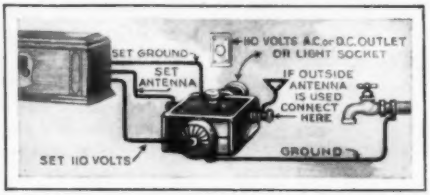
Linking Canada and the United States, the Ambassador bridge, recently dedicated, has a free span of 1,850 feet, 100 feet longer than that of the Philadelphia-Camden bridge which was the longest suspension viaduct before the completion of the huge structure at Detroit. The Ambassador represents the realization of a dream of thirty years ago, but it was completed in a little more than two years. It has an over-all length of about one and eight-tenths miles, and clears the Detroit river at a height of 152 feet in the center of the span, so that boats with tall masts can safely pass underneath it. Because of expansion and contraction during the heat and cold of summer and winter, the length of the bridge varies thirty-two inches a year. It cost $20,000,000.

FEATHERWEIGHT ROOF TILE IS CELLULAR

One-third lighter than ordinary concrete tile, a lightweight concrete roof tile, made of a material known as "haydite," has been placed on the market as a means of saving steel in roof construction. It requires no heavier steel design than any other form of roof covering and at the same time offers the advantages of permanence and fire safety. It is made from shale, ground and burned at a temperature of 2,000 degrees. In burning, oxidation of the carbon contents forms gases, causing the shale to expand into a light cellular structure. The material, a mass of trapped air cells the walls of which are vitrified fused shale, is crushed and used for mixing with concrete instead of the heavier sand and gravel. The cellular nature also gives the tile insulating value.

RADIO LIGHTNING ARRESTER DOES DOUBLE DUTY

Two lightning arresters are included in a single unit intended for use with the electric radio. One protects the set against lightning entering through outdoor antenna, and the other protects the radio against lightning entering through the light wires. The arrester also may be used as an indoor antenna. A filter between antenna and light circuit improves reception.


SET GROUND
SET ANTENNA
110 VOLTS A.C. or D.C. OUTLET OR LIGHT SOCKET
IF OUTSIDE ANTENNA IS USED CONNECT HERE
SET 110 VOLTS
GROUND

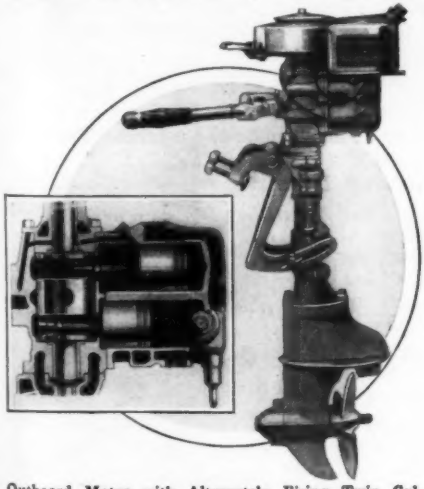
Lightning Arrester for Radio Which Protects from Charge through Antenna or Light Wires

OAT HULLS AND HARD RUBBER MAKE TOUGH MATERIAL

Oat hulls and hard rubber, in equal parts, have been combined to produce a material of great toughness used in making silent gears and for other purposes where excessive wearing action from friction is a factor. The oat hulls, costing about $38 a ton, are very durable, and when combined with the rubber, form a substance that will break only under great stress, and that takes a high polish. Because the hulls have a dulling action on tools, molding rather than machining is employed to fashion the material.

LATEST OUTBOARD TWIN FIRES ON ALTERNATING CYLINDERS

Outboard motors have been developed with alternately firing twin cylinders, thereby producing two impulses per revolution instead of one, and increasing smoothness of power flow while decreasing pulsations. Full pivot steering is combined with underwater exhaust, something that has not been accomplished previously. Many of the features of the modern automobile engine are included in the outboard motors, particularly the carburetor



Outboard Motor with Alternately Firing Twin Cylinders, Producing Two Impulses Per Revolution

design. Another feature is an automatic back-pressure relief valve which closes at high speeds and opens at low speeds.

Electric Deodorizer Which Kills Germs and Purifies the Air by Generating Ozone

ELECTRIC DEODORIZER KILLS SMELL OF COOKING

Destroying the odor of cooking fish, cabbage or onions, and other unpleasant household smells, an electric deodorizer is now on the market. The apparatus, in a small cabinet resembling a jewel box, may be operated on any alternating-current 100-volt circuit and generates the concentrated and activated form of oxygen known as ozone, quite often noticeable in the atmosphere after a thunderstorm. It clears a room of tobacco smoke and also aids in purifying the air because the ozone tends to kill germs.

SAFE "LISTENS" FOR BURGLARS

Mechanical ears are provided for a type of safe which "listens" for burglars and, on hearing them, sets off an alarm. Any noise, such as drilling, made in an attempt to open the safe when the alarm is on, sets up vibrations in the "ears" which cause the ringing of an alarm bell and the switching on of lights.

¶Military airplanes of all-steel construction are being built in France; equipped with 500-horsepower motors, they have a speed of 167 miles an hour in spite of their greater weight.

WALKING ON WATER MADE EASY WITH INFLATED SHOES

Shoes Attached to Inflated Cushions and an Inflated Staff Form Water-Walking Apparatus

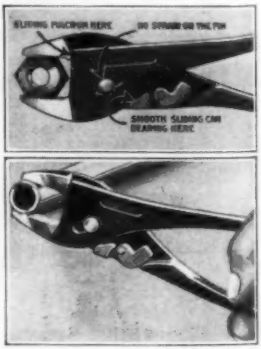
Walking on water is made comparatively simple with a pair of inflated shoes and a staff with an inflated bottom, the invention of an Ohio man who hopes to walk across the English channel. The water-walking apparatus resembles a pair of shoes resting on cushions. The shoes are laced onto the walker's feet, the bottoms are inflated and a staff with an inflated end to preserve balance completes the equipment. The inventor believes the shoes will appeal to fishermen accustomed to standing in hip boots.

MORE THAN HALF OF AIR DEATHS DUE TO PILOTS' ERRORS

A study of all accidents in naval aviation during the last eight years shows that fifty-two per cent of the total number of crashes were due to pilots' errors. Power-plant failures caused but eighteen per cent of the accidents, and the weather but two per cent. Pilots were found to be responsible for three-fourths of the fatal accidents. The investigators also discovered that the infrequent flyer is the most dangerous pilot, the records revealing that men who quadruple their frequency of flying, approximately halve their accident hazard. The naval data show that the most dangerous period for the flyer is about his 200-hour mark. Then he is likely to become overconfident and, with the involved maneuvers he is likely to perform at this time, his chances for serious accidents are bound to increase, although the seasoned flyer was found to have only one-third as many accidents as the recent graduate from the flying school. Among the underlying causes of many crashes was the lack of appreciation on the part of the pilot of the definite limitations to which he should have held himself; in other words, a tendency to be careless. Among the accidents due to pilots, sixty-three per cent were caused by faulty flying technique and nineteen per cent by faulty judgment. Of the crashes due to power-plant failures, nearly half were caused by failure of the fuel system, thirteen per cent by the ignition and twelve per cent by the lubrication system. Nearly half of the fatal accidents followed the dreaded tail-spin, usually at a low altitude where recovery is difficult.

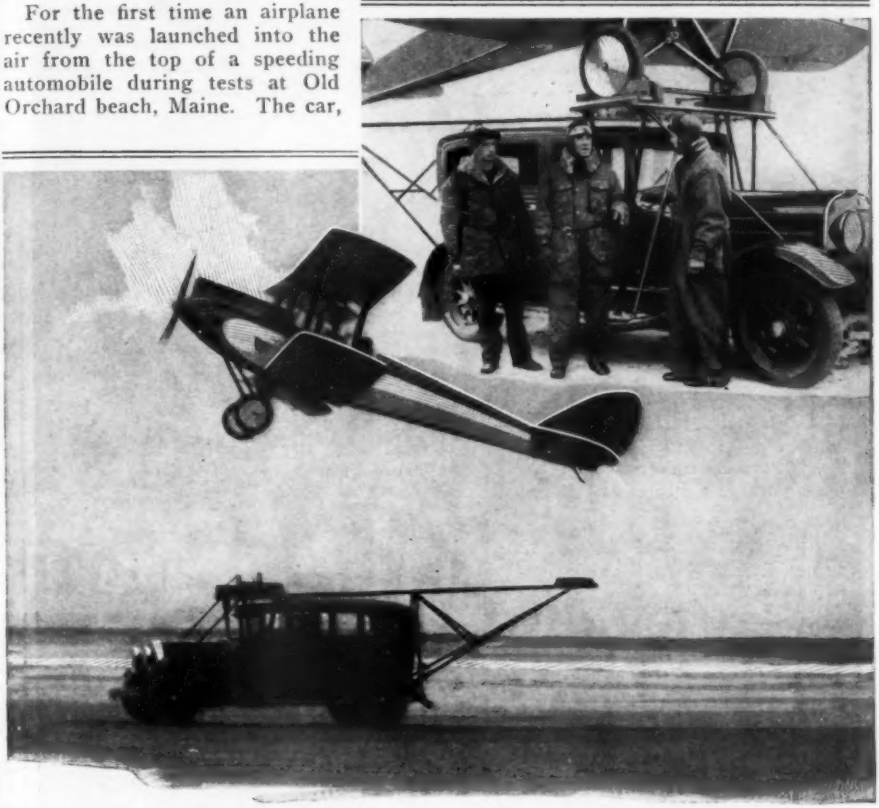
PLIERS GRIP WITHOUT SLIPPING ON ROUND SURFACE

Combining the principle of the cam, the fulcrum and the wedge, pliers that will not slip, even when gripping a round surface, now are on the market. The tool thereby performs work for which other appliances heretofore have been necessary. It eliminates the pin as a point of strain, the cam sliding the fulcrum to the correct position to wedge the work between the jaws in a viselike grip. It contains no screw adjustment and grips with the slightest pressure.



PLANE LAUNCHED FROM TOP OF SPEEDING AUTO

For the first time an airplane recently was launched into the air from the top of a speeding automobile during tests at Old Orchard beach, Maine. The car,



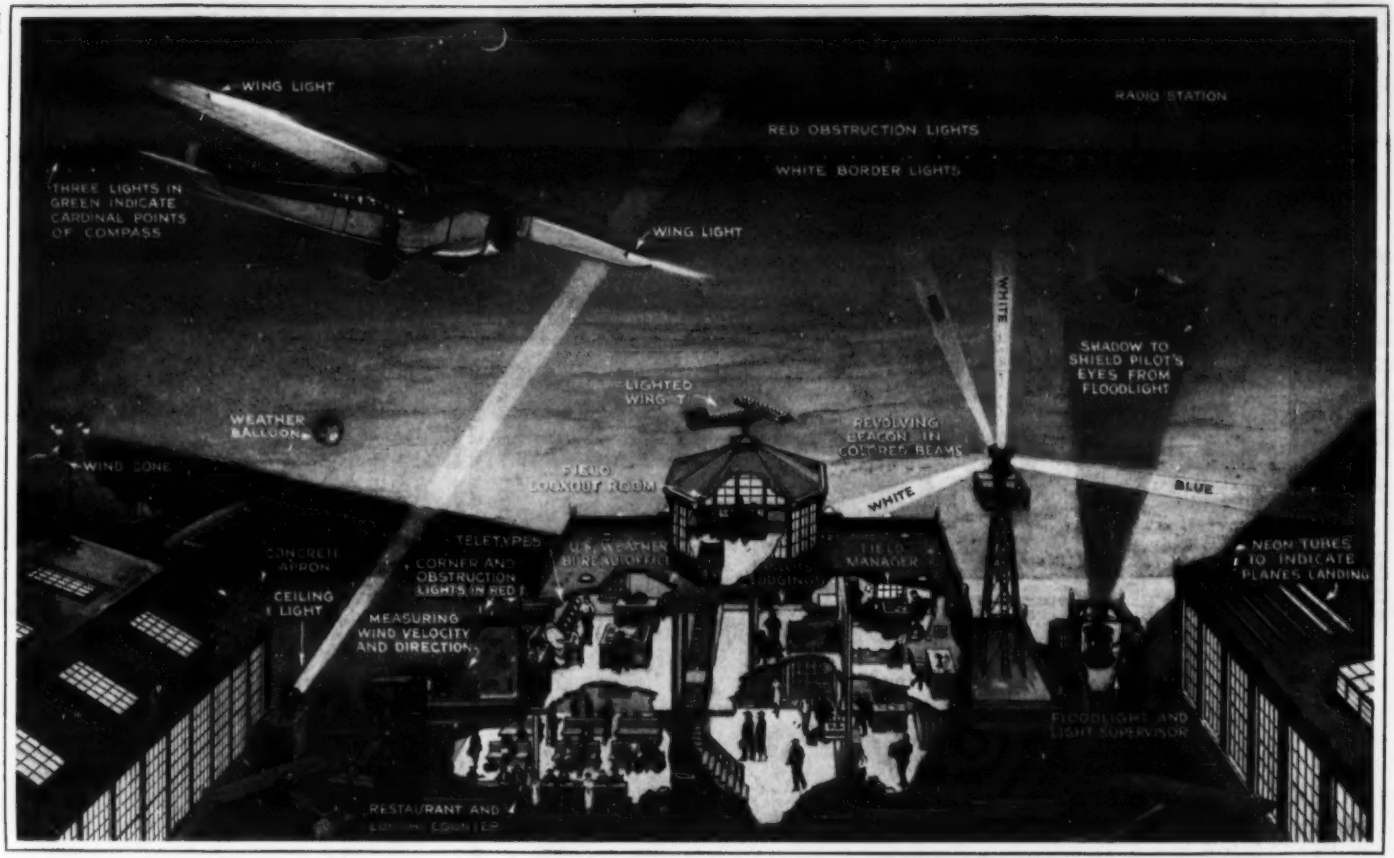
Upper Right, Airplane Resting on Frame on Top of Automobile from Which It Hopped, as Shown Below, When the Car Had Attained a Speed of Fifty-Two Miles an Hour

carrying the plane in a frame on its roof, gathered a speed of fifty-two miles an hour before the ship, which weighed more than 1,300 pounds, left the car top and proceeded under its own power. Both plane and car were standard stock models.

STUN FISH WITH ELECTRICITY TO LAND THEM EASILY

Tuna fishermen off the coast of Mexico are stunning the large fish with electricity to make the landing easier. The fish travel in schools according to size and cannot be caught in nets but only with poles and hooks. Fishermen running into a school averaging 100 pounds or more each often were faced with difficulties in landing the catch. Now, however, many of the boats are equipped with 110-volt direct current. On one side of the circuit is a small steel plate which is thrown into the water. The other side of the circuit is carried to the steel hook with a small insulated wire. Once the fish is hooked, a switch is closed sending sufficient current through the fish to stun it. Swordfish, weighing from 300 to 1,000 pounds and requiring seven or eight hours to land, have been pulled in within five minutes after being stunned.

¶A rocket-driven bicycle has been constructed by two German racers.



Some of the Important Details of a Modern Air Terminal; This Drawing, Based on the Cleveland Airport, Which Is One of the Best Equipped in the Country, Shows a Few of the Interesting Activities and Units Required for the Safe Operation of Planes at Night and during Times of Poor Visibili.y

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The Conquest of Fog

Pilot Using Special Phone Transmitter Developed by Bell Telephone Laboratories; Note How It Is Shaped to Keep Out the Plane's Noises and to Permit Easy Use

FOG, the last great bugbear of aviation, has been conquered.

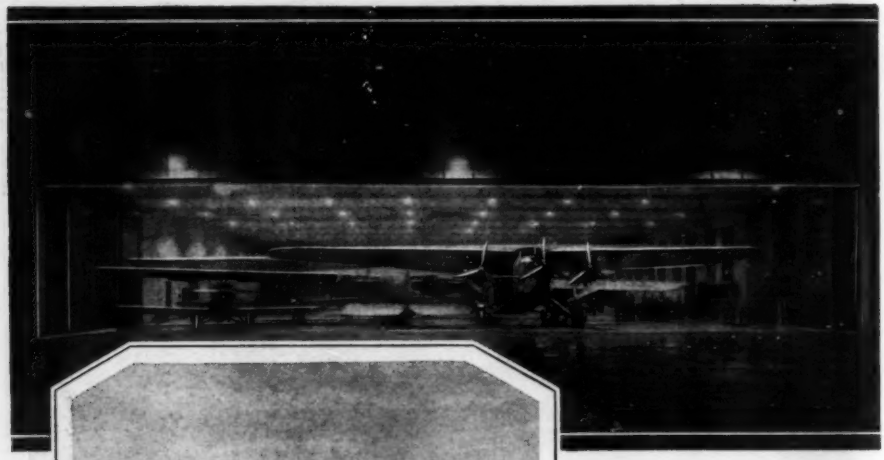
The application of the conquest to commercial aviation remains to be brought about, but a year of experiments, just completed on Long Island, have evolved an instrument that seems to be the answer to the flyer's prayer. Lieut. "Jimmie" Doolittle, the army's flying ace, did the actual experimental work, and the Guggenheim Fund for the Promotion of Aeronautics, of which Colonel Lindbergh is a director, financed it, but behind them was the combined research departments of four great organizations: the Sperry Gyroscope company, the General Electric company, the Bell Telephone laboratories and the Bureau of Standards.

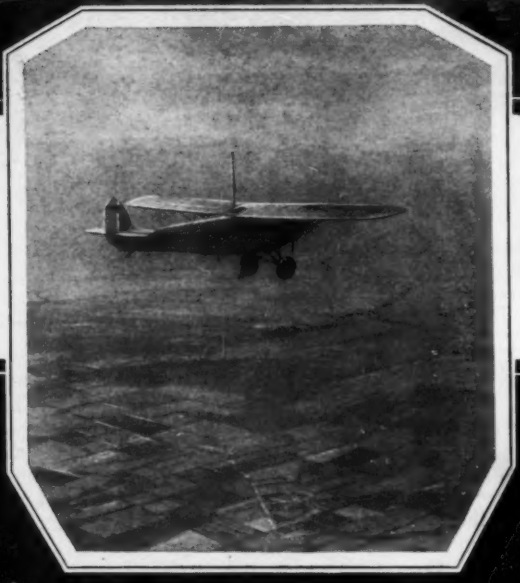
The solution they reached, with the combined inventive genius of several thousand trained scientists battling with the problem, is an adaptation of the sonic depth finder used on many big liners at sea. The aerial depth finder, however, is super-sonic, for it employs sounds of such extremely short wavelength and extremely high frequency that they are inaudible, not only to man, but to the highly sensitive ear of a cat.

These super-sonic sounds, at a frequency of some 26,000 cycles, will descend from the plane and send back an echo from the ground, while an electrical recorder automatically measures the elapsed time and translates fractions of a second into feet and hundreds of feet.

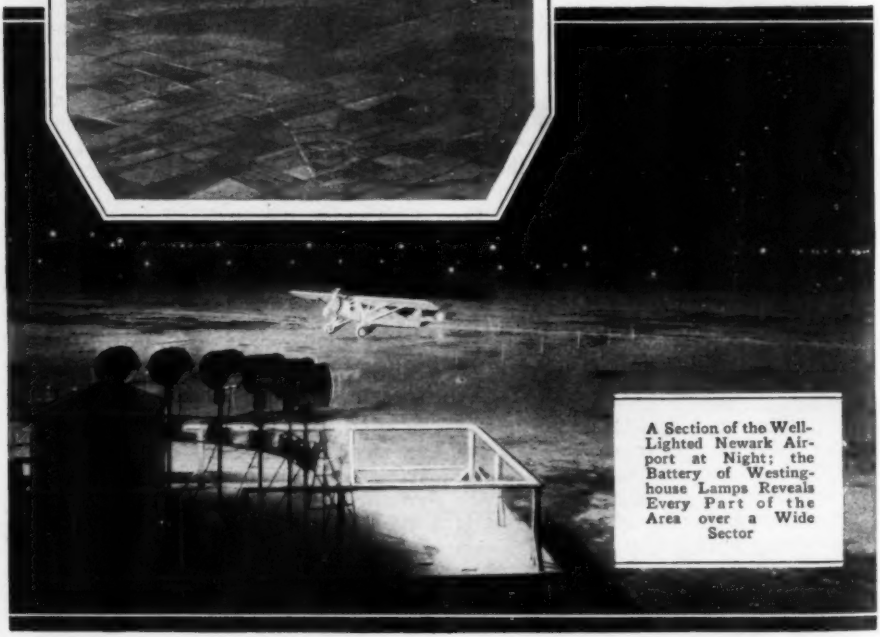
In its essence the plan differs but little from the experimental work done a year ago by the General Electric with a radio altitude finder, but that little difference represents the margin between failure and success.

The difference is merely the difference in speed of light or radio waves, and the speed of sound waves. Radio, like light, travels at 186,000 miles a second. Given an altitude of 5,000 feet, the radio wave, traveling that distance and back, would return in eighteen thousandths of a second, an extremely small lapse of time to be measured, and when the plane got down to 100 feet or so, where a fog altim-

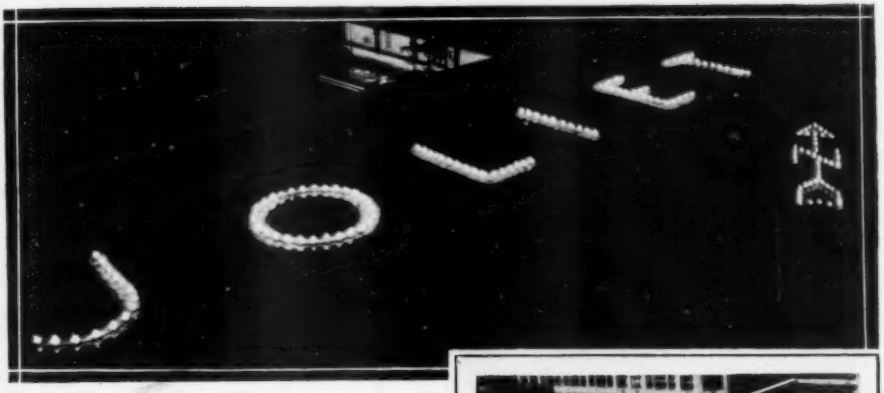


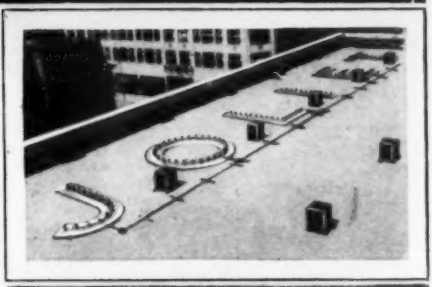


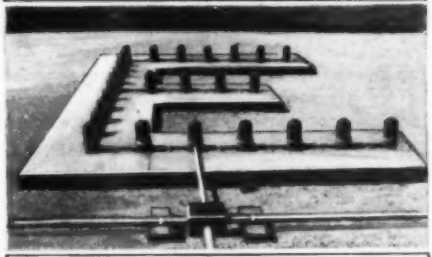
Night View of Interior of Universal Air Lines Hangar at the Cleveland Airport; Passengers Are Discharged on Concrete Platform in the Foreground; at Left, One of the Bell Telephone Company's Air Laboratories in Flight; the Radio Mast Is Now Commonly Seen on Many Transport and Mail Planes Since Wireless Has Proved So Efficient in Enabling Pilots to Guide Their Ships at Night and through Bad Weather

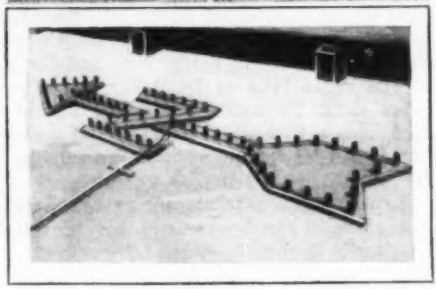


A Section of the Well-Lighted Newark Airport at Night; the Battery of Westinghouse Lamps Reveals Every Part of the Area over a Wide Sector









A Welcome Sign for the Airman; Joliet Says It in Lights with a Guiding Arrow

eter really is important, the speed of the radio wave is so great that accurate measurement becomes almost an impossibility.

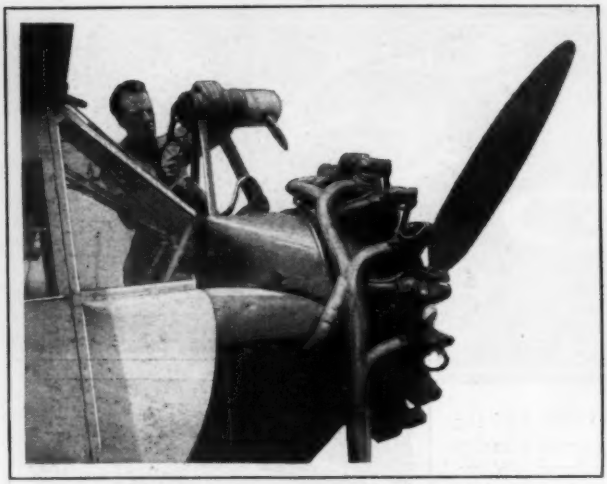
But, compared with that, the speed of sound waves through the air is only 1,087 feet a second. Sonic depth finders at sea, because of the fairly slow speed of sound through water, can measure depths of a few fathoms, though sound travels 4,708 feet per second in this medium.

Moving at their relatively slow rate, sounds in the air can be broadcast from a plane, reflected back from the earth, and the time taken for the echo to return measured accurately when the plane is not more than thirty feet in the air. And as super-sonic waves, inaudible even to the family cat, are to be used, the widespread application of the device to thousands of planes will cause no annoyance on the ground.

One peculiarity of super-sonic waves is the enormous power required to project them any great distance. The air absorbs them rapidly.

"It takes," says Elmer Sperry, the famous inventor of the gyroscopic stabilizer, the gyro-compass and the high-intensity arc light, "twenty horsepower of energy to project super-sonic waves a half mile. However, as the flyer needs no warning of objects more than 1,000 feet distant, we can produce sufficient energy without too great weight of apparatus, using a battery and radio apparatus."

Details of the apparatus itself are being closely guarded, and will not be made public until the Guggenheim Foundation issues its formal report, probably some time during the winter. Nothing is known beyond the fact that a radio oscillator is used to produce the high-frequency waves, and an automatic electrical recorder to pick up the reflected sound and



Wind-Driven Generator Which Supplies Filament and Plate Current for the Plane's Radio Transmitter and Receiver

translate the elapsed time into a measurement in feet.

Supplementing the super-sonic altimeter, will eventually be two systems of radio beacons, one, nine stations of which have already been installed by the department of commerce, covering routes between airports, and the other, a purely local beacon, broadcasting down the best runway of the flying field. Whenever fog or storm conditions will make landing difficult, the latter beacon will be on.

An incoming plane, arriving over the airport on the long-range beacon, will tune to the wavelength of the local beacon and locate the direction and length of the runway from it, flying back and forth in the radio lane as he descends. The super-sonic altimeter will guard his descent down to a point where the ground below will be visible, even in the thickest fog.

Experiments, carried out by the London office of the Sperry company during England's famous "peasoup" fogs, proved that a moving object below was visible from as high as fourth-story windows, while one standing still could not be seen from the second floor. As everything below is moving, in relation to the plane, the pilot gets what Mr. Sperry describes as a "barber-pole effect," the ground flashing by in alternate stripes of darker and lighter colors, as the terrain varies.

In the London experiments, a white sheet was tied to the top of an automobile, and the car driven past the Sperry offices, and then parked, thereby determining the altitudes at which moving and stationary objects could be seen in a dense fog.

The radio division of the lighthouse service, under which airway beacons, either radio or lights, come, has completed the installation of radio beacons from Boston to Des Moines, with intermediate plants at Hadley Field, N. J., Bellefonte, Pa., Cleveland, Goshen, Ind., Chicago, and Sterling, Ill., while a ninth has been installed at Key West, for the Havana route. These are in addition to the army-controlled beacons at San Francisco and Hawaii.

Installation of fifty more radio beacons by the lighthouse service has been approved, and within two years it is expected that every important air route in the country will be fully protected by radio.

No two adjoining beacons use the same code letters, so the pilot flying from one beacon zone into the next has no trouble picking up the new signals. Each beacon transmits two sets of code signals, which, on the true course, blend to form a third signal. The standard radio alphabet signals for the letters "B" and "V" are used in one set of beacons, "D" and "U" in a second, and "A" and "N" in a third. If a flyer is on a course between the A and N-signals, for example, he hears the letter "T" in his headphones.

Although the radio beacons, with two antenna systems spaced at right angles, would normally send out signals in the same way, it is possible to correct them with additional apparatus so they can be sent in any desired direction, thus shifting each of the four available courses to mark a direct course to another city, re-

gardless of its compass bearing in relation to the other three.

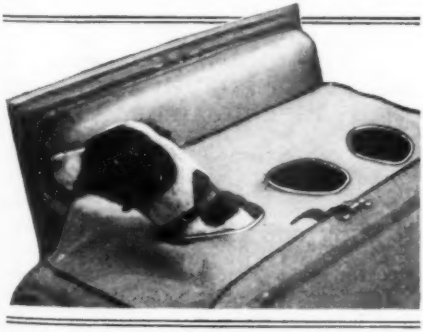
The radio receiver used in the airplane is a simple set, weighing, complete with batteries, but eighteen pounds. A vertical antenna, carried by a pole above the fuselage, is used instead of the now obsolete trailing wire.

In addition to the other devices already in use or projected, the department of commerce has approved short-range radio telephones for use at airports to direct planes about to land. All airports in the country will operate these transmitters on the same wavelength, so they are limited to a range of not more than five miles. The pilot of an approaching plane can get his landing directions from the airport manager through the same receiver used for the beacons, and, while he will not be able to talk back, unless a portable transmitter is installed on the plane, the ground crew, by listening to his motor, can give valuable advice and directions even in a dense fog.

Terminal Equipment for Plane-to-Ground Transmitter at Airport Weather Station

DOGS CARRIED IN RUMBLE SEAT COVERED WITH CANVAS

Another use for the rumble seat has been found by a Pennsylvania dog fancier who hauls his prize winners about in the rear seat of his car which has been made into a kennel by fitting a strong canvas cover over the opening around the rumble seat. The cover was attached with snap fasteners, and over the seat three holes were cut, to allow the dogs' heads to protrude. When traveling, the dogs may enjoy the fresh air without escaping, and when tired, they may curl up in the seat.



Rumble Seat Fitted with Cover and Ventilators for Carrying a Dog Fancier's Prize Winners

PACKING FROZEN RAW FRUITS

Packing frozen raw fruits, berries and vegetables in small containers to preserve the original flavor of the fresh product is being studied by the department of agriculture. More than 10,000 cans have been packed by various freezing methods and placed in cold storage to determine the best method of preserving the fresh flavor, and at the same time keep the fruits from spoiling. The experiments are being conducted for the benefit of officials enforcing the pure food and drug act, and to supply packers with accurate information regarding the various processes.

LIGHTS RULE MOB SCENES IN TALKIES

Faced with the problem of directing a mob scene in a talking picture in which 5,000 persons participated, without having his voice picked up by the sensitive microphones, one director solved the difficulty by using a system of light and flag cues, thereby enabling the photographing of sight and sound simultaneously. Heretofore mob scenes were shot in the silent way and the sound was supplied later by a crowd of extras. The director in charge of filming the talking-picture mob scene was perched on a building high above the scene and in front of him was a ground plan showing every entrance, window and door. On his layout were electric switches connecting with lights at each door, window and archway. He pressed a switch to start the cameras, then, by pressing cue lights, hidden from the cameras, gave the signal which started the first of the mob on the scene. Headphones gave the director the sounds exactly as they would reproduce and a hand phone connected him with the sound man so that he was able to govern the volume. Switch after switch was pressed to release more of the hidden actors and, during a battle, a red flag above the director indicated to the actors that one section was to retreat slowly, and a white flag, run up after a master switch released all the cue lights and brought reserves, showed the thousands of actors that the tide of battle had turned. The scene finished, the director pushed a button stopping the cameras and sounded a siren indicating to the actors that the cameras had ceased grinding. It has been suggested that a modified system of light and flag signals might be used to direct troops in battle.

Mob Scene from Talking Movie Being Directed by Cue Lights; These Are Governed by the Director, Seated at the Switchboard

AERIAL BOMBING OF PORPOISES PROTECTS FISHERIES

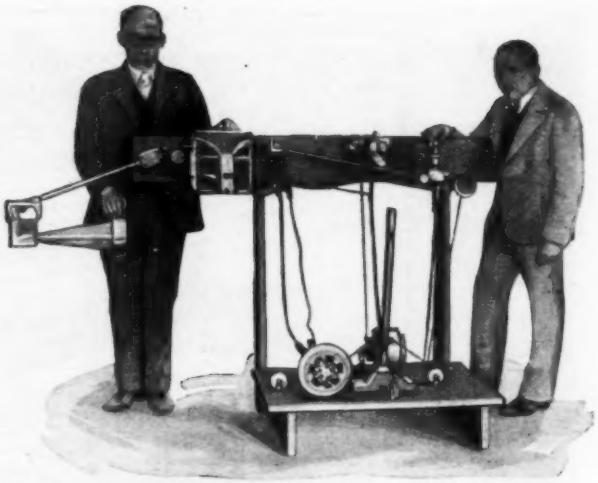
Airplanes equipped with bombs similar to those used in war time have come to the aid of the fishing industry along the lower St. Lawrence river, which was threatened with destruction by the voracious appetites of porpoises. The Quebec department of game and fisheries first employed expert marksmen, but they made no headway, so airplanes and depth bombs

were tried. The porpoises, however, are such swift swimmers they usually scattered as soon as the bombs hit the water, and the weapons then were changed to bombs that exploded as soon as they struck the surface. This proved the most effective method and several bombs dropped on a school kill many outright, injure others and send the survivors scurrying in all directions.

GLOBE OF RUBBER IS INFLATED LIKE BALL

Intended for use in the classroom and to allow children to absorb useful facts while playing, a rubber globe of the world that may be inflated like a basketball now is available. The globe inflates to twelve inches, is equipped with a folding stand, and may be obtained with colored maps on its surface, with the outlines of the maps for crayon coloring by children, or with a plain surface. The bladder inside the globe can be replaced at small cost.

Rubber Globe of the World Mounted on Folding Stand; the Globe Is Inflated like a Football



Automatic Plane Stabilizer, Embodying the Principles of the Vane and Pendulum, to Keep the Ship in Level Flight Constantly

AUTOMATIC PLANE STABILIZER LIKE VANE AND PENDULUM

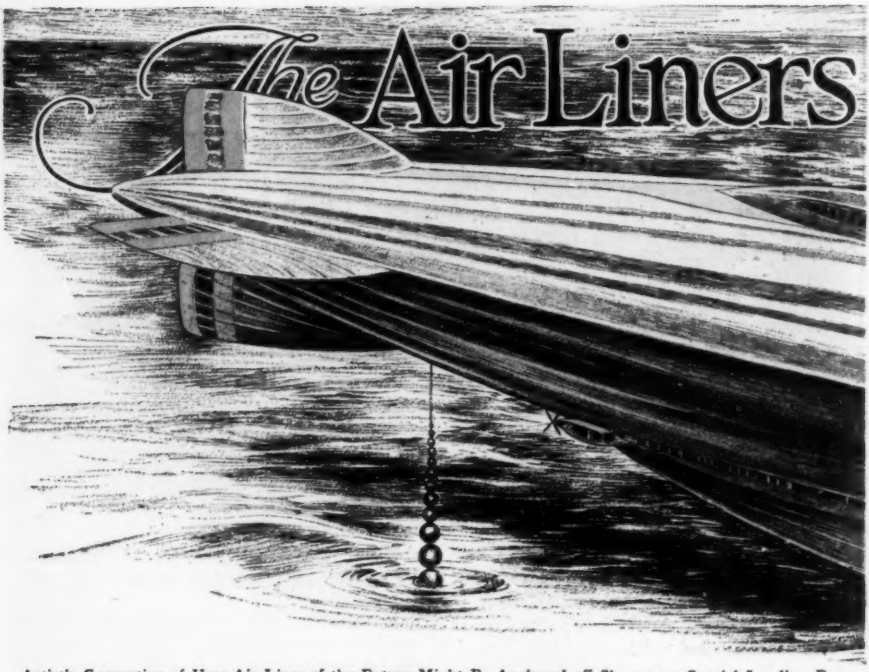
Combining the principles of the vane and pendulum, an Ohio inventor has made an instrument for automatically stabilizing an airplane in flight. The control reacts to any disturbance of the plane laterally or fore and aft, thus keeping it in level flight without the aid of the pilot. It maintains balance more evenly and acts more quickly than any human agency and is expected to be particularly valuable in night trips, bad-weather flights and emergency landings. It is also believed that it will greatly reduce the effect of "bumpy" air, and so prove helpful in passenger transports.

FAN BLOWS POISON IN ANTHILL

Blowing poison into anthills with an outboard motor is one way of killing the ants. A resident of South America, unable to rid his premises of the pest by any other method, rigged up an exterminator consisting of a blower fan run by an ordinary outboard motor. With this equipment he was able to blow poison into the hills and kill the occupants instantly.

¶Sea water contains 1,500 tons of solid matter per cubic mile.

The Air Liners



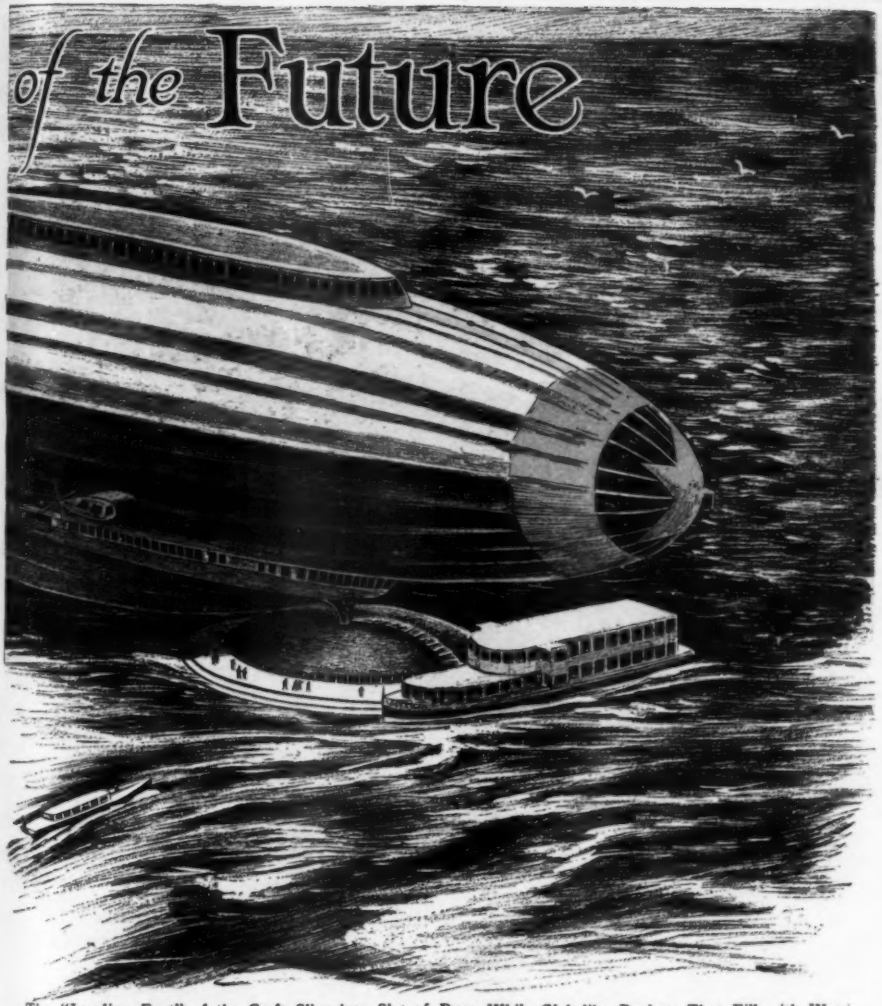
Artist's Conception of How Air Liner of the Future Might Be Anchored off Shore on a Special Landing Buoy in Regions Where Construction of Hangars Is Impractical

By JOHN DRAPER

THE DREAM of inventors who pictured the day when huge air liners that would bring Podunk within a few hours of Paris, seems about to be realized. Count Ferdinand von Zeppelin flew his first successful rigid airship in July, 1900, over Lake Constance on the German-Swiss border. Since then, there has been rapid development of this mode of travel. The World War helped tremendously, but it is only within the past year or two that the Zeppelin has become a transportation factor. The "Graf's" world trip was a realization of Count Zeppelin's dream wherein he saw all countries of the earth linked by huge swift-flying air liners.

The voyages of the "Graf" demonstrated many things about airship navigation over long distances. That there is need for better methods of obtaining reliable weather reports is one of the most outstanding. Throughout the twenty-one-day world journey, Dr. Hugo Eckener had to rely largely on his own experience and perception of conditions to determine the best courses. He received weather reports over Europe, America and the oceans, but this information was almost entirely lacking over Asia and left much to be desired at other points. Undoubtedly, when airship travel becomes an everyday matter, there will be a well-organized network of weather stations, radio transmitters, and like equipment, covering the earth. Then the condition of the weather will have only a limited effect on airship-line operation.

Builders of the "Graf Zeppelin" had to make it to fit the only large hangar available in Germany. Therefore the ship is not of ideal proportions. Its steering mechanism is not entirely satisfactory, and its speed is too low. Doctor Eckener, following the world trip, declared that future long-distance airships ought to be fatter—have a lower ratio between length and diameter—than the "Graf." They also must be more powerful if they are to

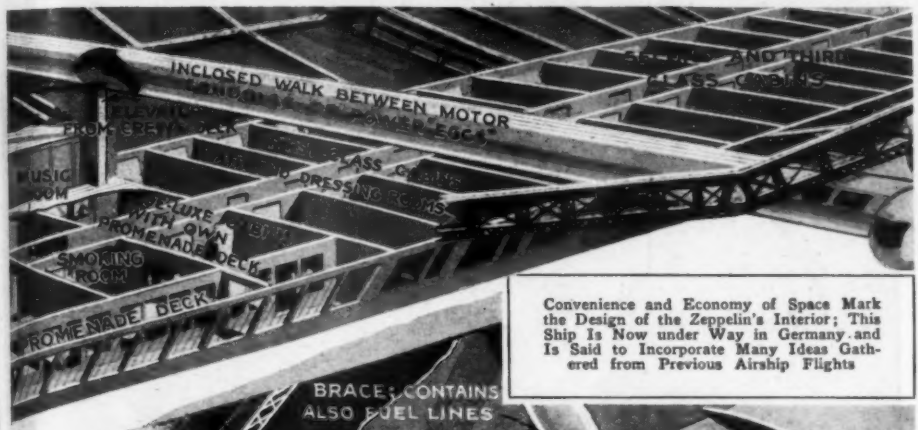


The "Landing Foot" of the Craft Slips into Slot of Buoy While Globelike Buckets That Fill with Water Are Lowered from the Rear to Serve as Anchors

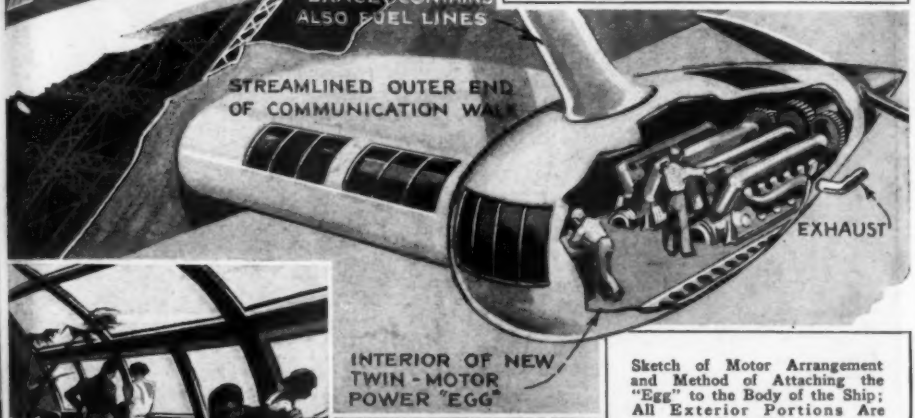
maintain reliable schedules regardless of weather. The "Graf" also suffered from a kind of skin affliction. That is, its fabric covering became loosened in several places during a long flight. This was remedied by installing light reefing frames. In future ships, adjustable bars will be provided so that the fabric can be loosened or tightened as desired.

Many improvements which the "Graf" lacked are being embodied in the new German dirigible now under construction at Friedrichshafen, the two British ships "R-100" and "R-101," and the United States navy airships "ZRS-4" and "ZRS-5," now being built at Akron, Ohio, by the Goodyear-Zeppelin corporation. The new German dirigible is thirty per cent larger than the "Graf"; has eight motors instead of five, and retains the outside motor gondolas because inflammable hydrogen gas will be used for lift. It will be completed in the spring of 1931. The "R-101," recently flown, is shorter than

Details of New German Liner Now under Construction; Plans for the Craft Were Developed from the Performances of the "Graf Zeppelin"

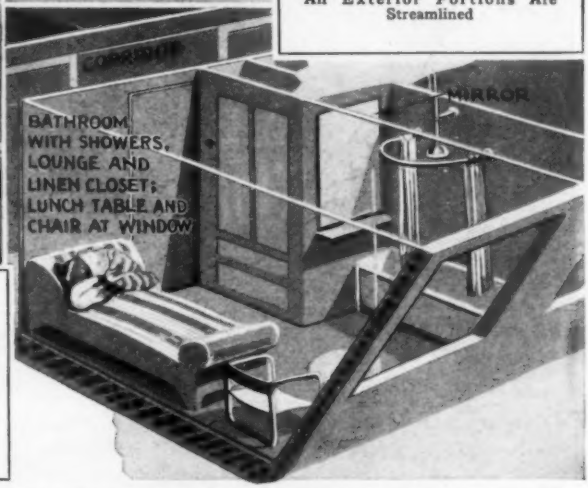


Convenience and Economy of Space Mark the Design of the Zeppelin's Interior; This Ship Is Now under Way in Germany and Is Said to Incorporate Many Ideas Gathered from Previous Airship Flights

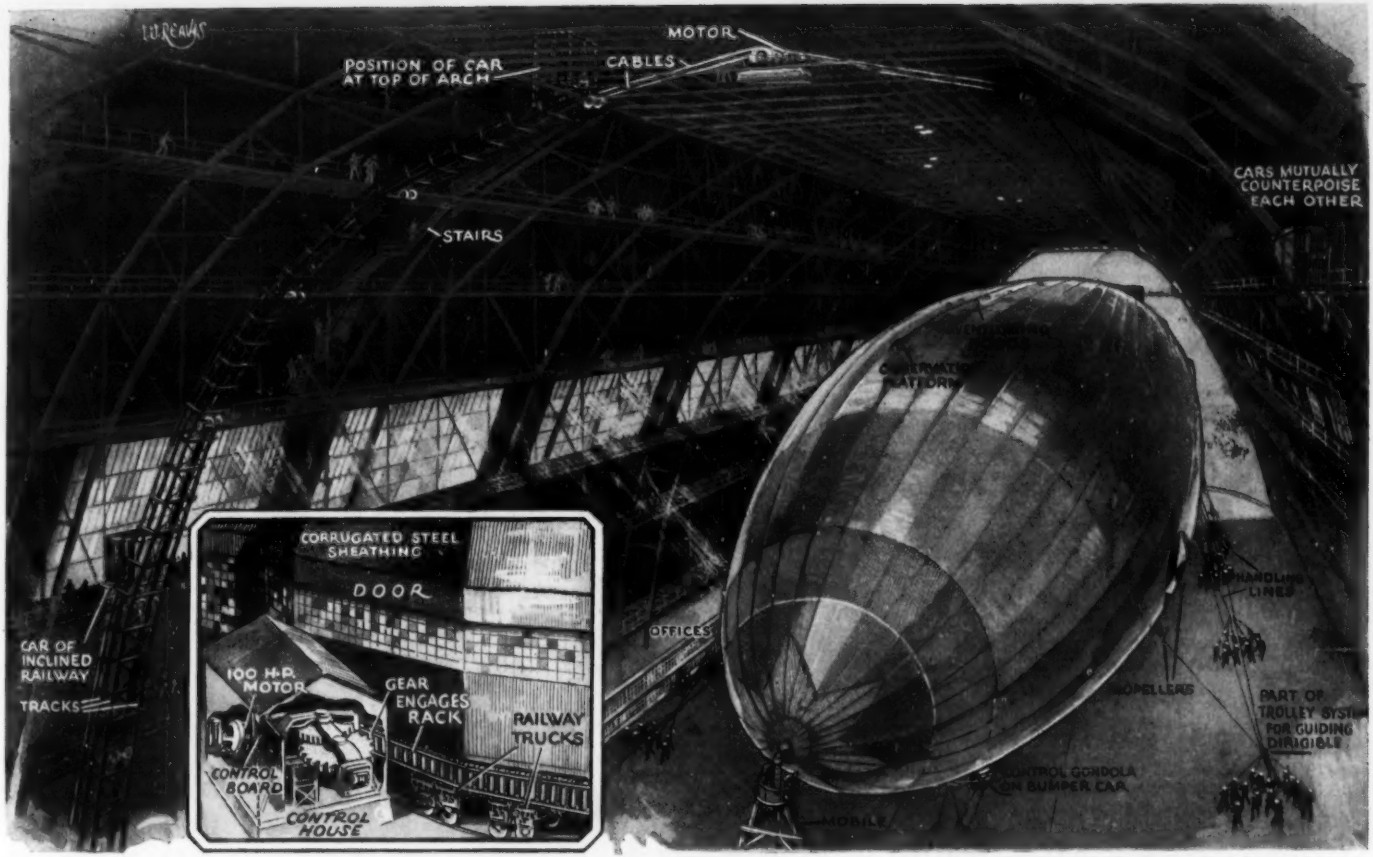


INTERIOR OF NEW TWIN-MOTOR POWER "EGG"

Sketch of Motor Arrangement and Method of Attaching the "Egg" to the Body of the Ship; All Exterior Portions Are Streamlined

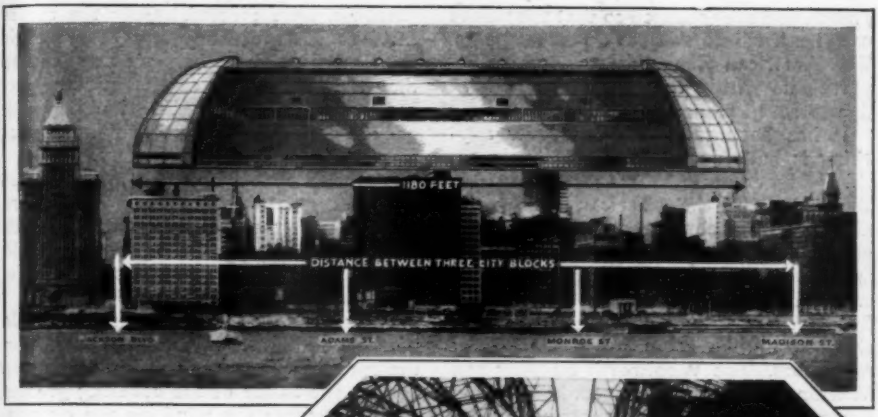


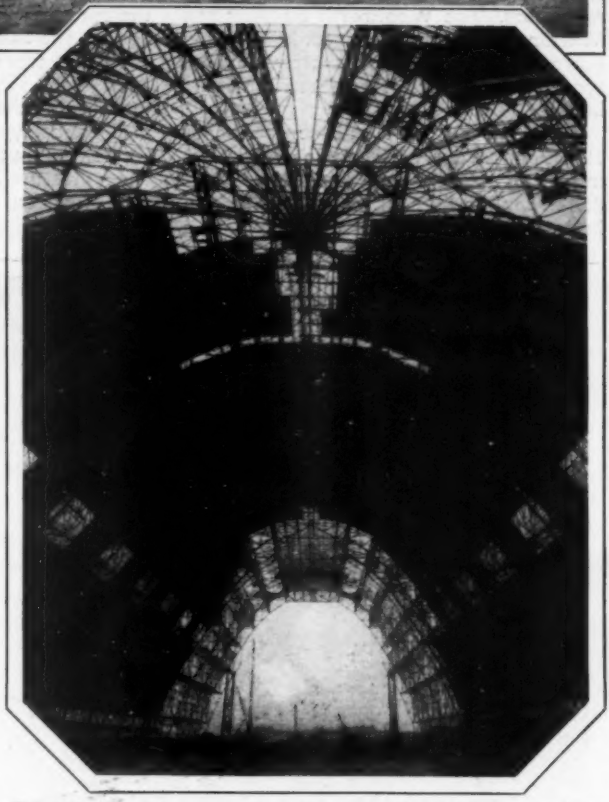
Luxuries like Those on Ocean Liners Will Be Common to the Big Craft of the Skies if Dirigible Traffic Fulfills the Hopes of Its Backers; a Brilliant Dining Room and Well-Appointed Bath Are Featured in These Sketches, Which Show Details of Craft Germans Are Building; the Race for Supremacy in Commerce Is Being Carried to the Skies



How Craft May Be Brought into the Dock of the Goodyear-Zeppelin Corporation at Akron, Ohio, and a Close View of the Operating Mechanism of the "Orange Peel" Doors; the First of Two Dirigibles for the Navy Is Now under Construction in This Huge Dock Which Was Completed Recently

How Craft May Be Brought into the Dock of the Goodyear-Zeppelin Corporation at Akron, Ohio, and a Close View of the Operating Mechanism of the "Orange Peel" Doors; the First of Two Dirigibles for the Navy Is Now under Construction in This Huge Dock Which Was Completed Recently





Composite Photo-Diagram to Show Size of the Dirigible Dock, and View of Interior When Structure Was about Three-Fourths Finished

the "Graf" but is fatter and therefore has a greater useful load. It departs from previous practice by using stainless-steel girders. Both the British and German ships hold approximately 5,000,000 cubic feet of hydrogen. The two new American ships are larger, being of 6,500,000,-cubic-foot capacity, but the lift produced by the helium they will use will be about equal to that of a 5,000,000-cubic-foot hydrogen ship. Because helium will not burn, these ships will represent many innovations in design. Almost everything will be inside the hull, where wind resistance is nil. The propellers and their outriggers, control surfaces and control room will be practically the only protruding parts. Motor rooms, being inside the framework, can be larger and of stronger construction. Passenger and crew quarters will be more extensive than in any previous airship. Each ship will have three triangular keels. Corridors, staterooms and other compartments will be located inside these keels.

Perhaps the most spectacular phase of the airship's growth is its recently acquired ability to carry airplanes. The new British ships, it is reported, are designed primarily as motherships for air-

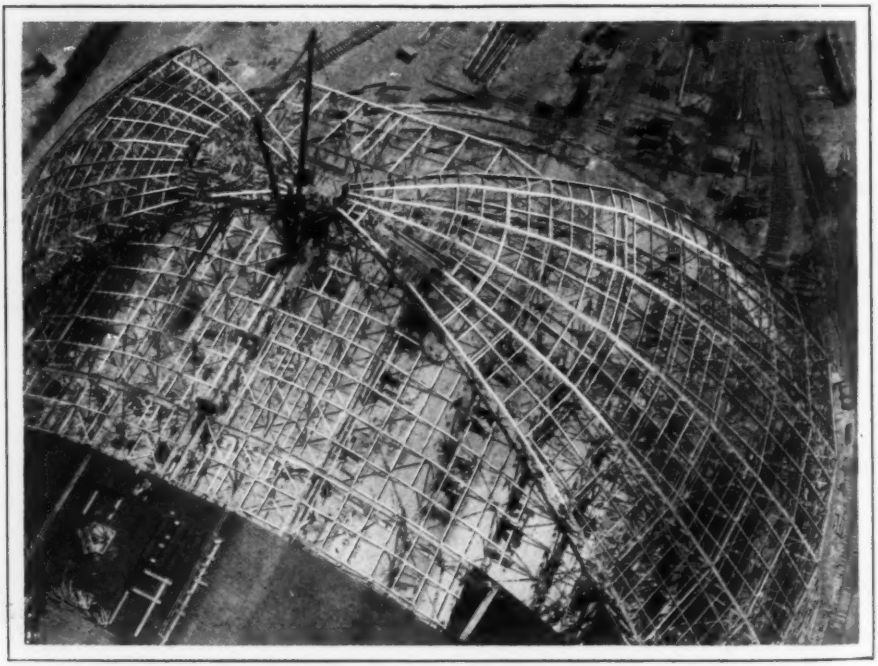
planes, and are equipped so that the planes can be used as auxiliary power plants. The American Zeppelins will have compartments within the hull that will hold five to seven planes, depending on size.

It has been said that, whenever anything is built on a gigantic scale, something bigger must be made to house it. Before building the American airships, the Goodyear-Zeppelin corporation had to erect a factory and dock at Akron which is the world's largest building without interior supports. Ten football games could be played in this dock at one time, and there would be room for thousands of spectators. The Woolworth building and Washington monument could be laid down side by side, and there would be space to spare for a few dozen ten-room houses.

The dock is of steel and concrete construction. First, 1,300 concrete piles, averaging twenty-five feet long, were driven for the foundation. Then thirteen huge steel arches, each the shape of a parabola, were erected. Only the center three arches are firmly attached to their foundations. The others are arranged so that they can move as the building expands and contracts. The building will change its length about five inches between extremes of temperature.

Doors that close the ends are the most interesting part of the dock. They are of the "orange-peel" type. That is, each section is the shape of the peel you would obtain by quartering one-half of an orange. Each door section weighs 600 tons.

When wind is blowing against one side of the building, a vacuum is created on the opposite side, often causing a pressure against the inside of the covering greater than that from the wind on the outside. Along each side, about a third of the distance from the top, are four dormerlike projections, with colored-glass windows. These are automatic louvers that open when pressure inside is ten pounds greater than that outside, preventing the steel plates from ripping off.



Looking Down on Southern End of the Dock from a Dirigible: There Are Several Men in This Photograph —but Try to Find Them

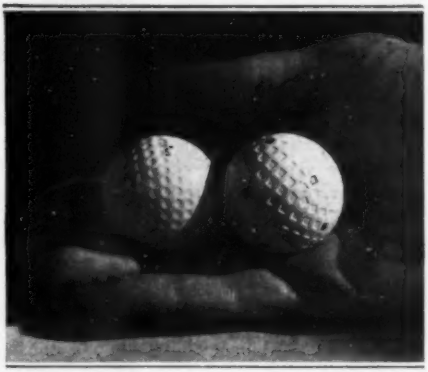
Artificial Tropic Sunlight Keeping Zoo Specimens in Good Health; Crocodiles, Alligators and Other Reptiles as Well as Animals, Used to Much Sun, Are Said to Be Benefited by the Lights

LIGHT RAYS FOR ZOO REPTILES PROLONG THEIR LIVES

Ultraviolet-ray treatments for turtles, crocodiles and other specimens have proved beneficial in preventing sickness among the zoo and aquarium families. Glass that permits the passage of the sun's helpful rays has been used to good advantage over the cages of monkeys and other tropical animals, and where it is not practical to employ such glass, special lamps are being sought for the artificial sunlight they produce.

LARGER, LIGHTER GOLF BALL TO IMPROVE GAME

Great interest is being shown among golf players in the proposed new ball, which is to be slightly lighter and larger than the old one. Some experts believe that it will be easier to hit, easier to stop on a green and more easily controlled on chip shots. On the other hand, it will roll less when it comes down, will not go so far and will not speed against the wind so well as the present ball. While present plans are that the new ball is to be compulsory only during tournaments, it is believed that its use will become almost universal. One reason for the change is said to be that expert players of today are able to hit the ordinary ball so far that courses, once considered difficult, have become comparatively simple ones.



Slightly Larger Golf Ball on the Right as Compared with Old One; the New One Is Also Lighter

What Your Tires

By WALTER E. BURTON

AUTOMOBILE tires are much like criminals. If they are misbehaving, they frequently can be caught through a study of their fingerprints. There is the difference, however, that the real criminal frequently is not the tire, but the driver of the car on which it is used.

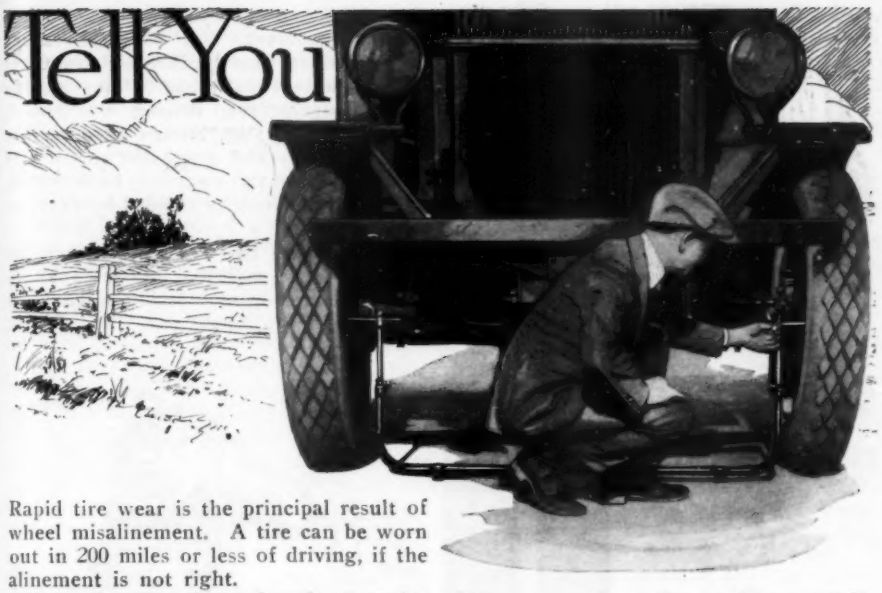
A tire's fingerprint is its track in the snow, mud or other surface over which it rolls. Because of the large size of tread details, it usually is easier to study the tire surface itself rather than the track. There are a number of human fingerprint classifications, each including one or more definite types of persons. With tires, the thing of greatest interest is tread wear; and there are several definite types of wear, each with its telltale fingerprint.

Suppose that, in examining the front tires of your car, you find the tread to be worn sideways across the surface of the casing. Closer examination reveals that one edge of the tread projections is worn round, while the opposite edge is feathered—has a little fringe of rubber all around. This condition is produced by sliding of the tire sideways, and the sliding is a result of wheel misalinement.

Uneven Wear on Front Tire Due to Insufficient Camber of Wheel

Front wheels of most automobiles are toed in, the amount depending on the type of wheels, axle, and the like. That is, the measured distance between the two front-wheel tires is less in front of the axle than back of it. The difference generally is from nothing to one-eighth inch. The purpose of the toe-in is to bring the tires parallel when the car is in motion. They normally have a tendency to move outward. If the toe-in is too little or too great, one or both of the tires will be subjected to a dragging or sliding action which rapidly wears away the tread. You can detect this condition by examining the tire surface closely. If the toe-in is too great, tread projections will be worn so that the outer edges are rounded, while the inner edges will be feathered—have little pieces of rubber projecting out like a fringe. If the toe-in is not sufficient or is negative, the wear is opposite, with rounded edges on the inner side.

Tell You



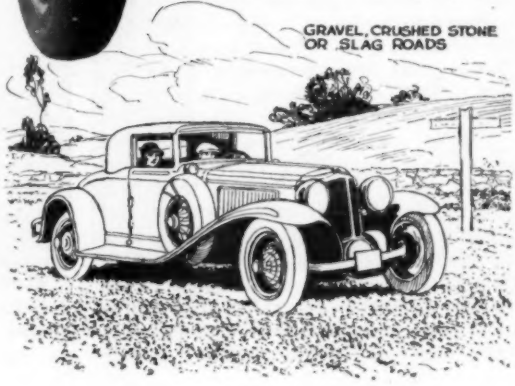
Rapid tire wear is the principal result of wheel misalinement. A tire can be worn out in 200 miles or less of driving, if the alinement is not right.

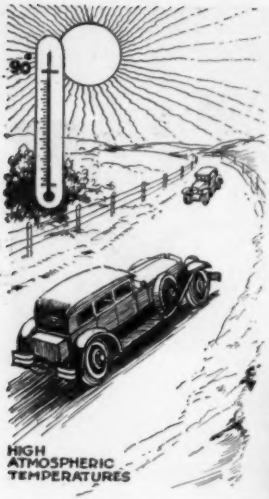
Now that you have found what tire makers consider one of the greatest criminals in tire wear, you can abolish him by having your wheels realined. This should be done every three months, with normal driving. Accidents, rough roads, striking of wheels against curbs, and similar incidents will destroy alinement.

But suppose you find that your front-wheel tires are wearing faster on one side of the tread than the other, and that the wear is uneven. This indicates that the camber—the angle at which the wheels are tilted—is faulty. Normally, the tilt is such that the kingpin points approximately to the center of the tire when the latter is inflated to the correct pressure, although the tendency among manufacturers recently is to use less camber. If you think that the wear is too rapid, have your camber checked. But if the wear is moderate, do not worry much about it, because it probably is normal. By reversing your tires every few thousand miles, you can offset the effects of camber wear, and obtain maximum service from them.

If you suspect that some mechanical irregularity is causing rapid wear of your tires, it is a good plan first to consult your tire dealer and get his advice. Then take your machine to a garage which is equipped to remedy the trouble.

Your automobile is a four-fingered animal, and so there are four fingerprints to inspect. If, on comparing all four prints, you find that one tire is rapidly los-





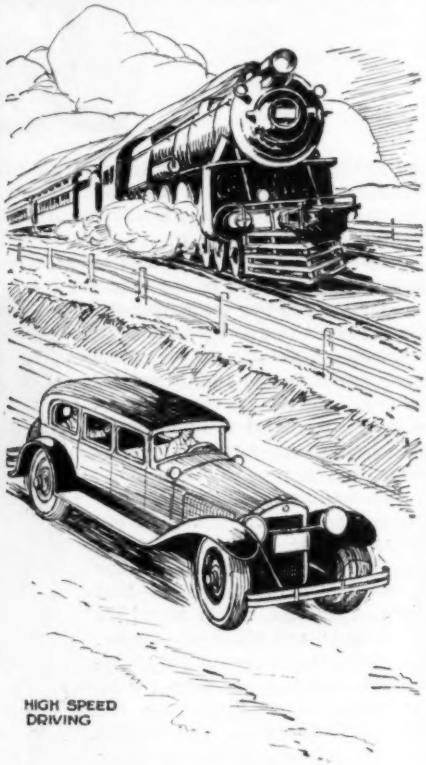
too fast. It is not necessary for a tire to slide to wear. When the brake is applied even moderately, the wheel is slowed down and a resistance is set up between the tire surface and the road. This causes little pieces of rubber to be torn from the tread. On cars having four-wheel brakes, wear caused by brake drag usually is even around the circumference of the tire. Sometimes, however, the driver finds that one of his tires is wearing in one or two spots, and that the wear is rapid. This indicates an egg-shaped brake drum, or one that has a high spot in it. Truing the drum in a lathe is the recommended remedy.

Perhaps an examination of your tires reveals that they all are wearing out more rapidly that you have reason to expect. The criminal in this case is yourself, or whoever else drives the car. If you analyze your driving, you will discover, more than likely, that you are the first to get under way when the traffic light flashes green, that you take turns at a fast clip, and "step on it" along the straight ing its ability to make tracks—is wearing rapidly, in other words—investigate your brakes. One of them probably is tighter than the others, causing the tire on that wheel to wear

EXCESSIVE TOE IN VS. HIGH CAMBRE

stretches; and that you stop at the last possible moment. All of these things cause tires to wear quickly, but there are several more equally bad. They include high temperatures, driving on gravel, crushed stone, slag, broken hard-surface roads, or hilly and stony dirt roads. Of course, some of this wear is to be expected, but much of it can be avoided by exercise of a little care.

If your car tires exhibit uneven or cupping wear, indicated by spots along the tread area, your steering mechanism probably needs attention. The wheels

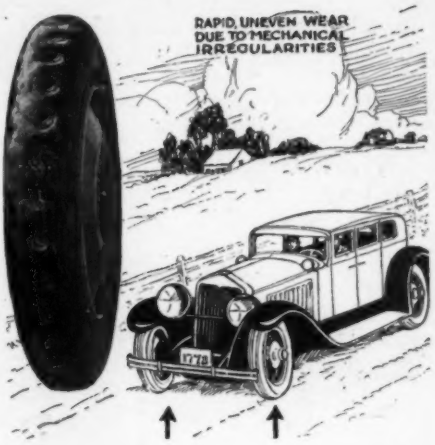


may be wobbly, and there is undoubtedly considerable play in the steering-assembly bearings and bushings. A complete overhaul will save you money.

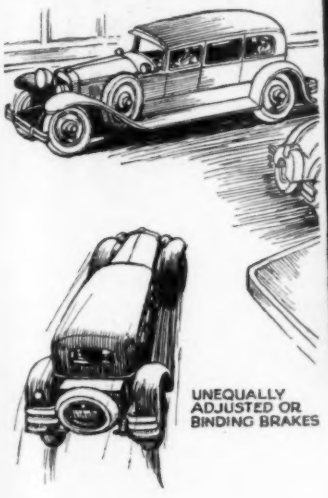
If your tires wear evenly along both tread edges, but the centers stand up distinctly, you have found the fingerprints of one of the greatest tire enemies—un-

derinflation. Balloon tires are particularly sensitive about their air pressures. That is why car and tire manufacturers go out of their way to inform you of the correct number of pounds required. Use a reliable gauge to test your tires, and inflate them at least every week. Oftener will not hurt.

When a tube has less than the recommended poundage of air, the casing is bent excessively. This causes the edges of the tread to undergo a wiping action over the road surface, wearing away rubber. But inside the tire, where you cannot see it, is still other wear. The cotton cords that make up much of the carcass are chafed back and forth over each other, with the rubber between them acting as a lubricant, much like oil between the leaves of a spring. If this chafing is excessive, due to low air pressure, injury to the tire will result. Underinflation further renders your tires susceptible to injury if the wheel strikes the edge of a hole, a curbstone, brick or other projection. Frequently the cords are broken, or the inner tube ruptured.



Overinflation is almost as great an evil as its twin brother, but it is perhaps not so frequently encountered. Its fingerprints show even wear in the center of the tread, but comparatively little at the edges. The effect of too much pressure is twofold. First, the center wears excessively. Second, the rear tires have a tendency to bounce and spin on rough roads, sometimes causing the car to hop to one side. If you don't hop into a ditch, you are fortunate, but your tires still are wearing far too rapidly, and your rear-axle assembly is not being benefited.

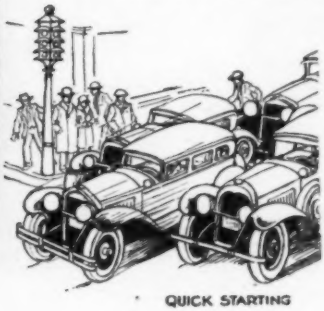


UNEQUALLY ADJUSTED OR BINDING BRAKES

UNDER INFLATION VS. NORMAL CAMBRE

The principal classes of tire fingerprints mentioned are supplemented by a host of subdivisions. But only the most common need worry you. If you find a type of tread wear that proves puzzling, the best thing is to seek a reliable tire-service station at once.

In arriving at a conclusion

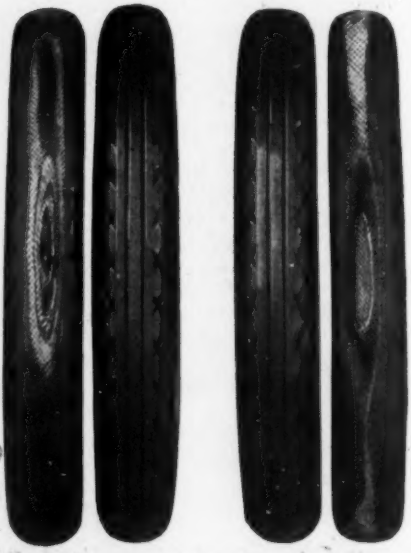


QUICK STARTING

about tire wear, take into account the conditions under which you drive. High speed, frequent use of brakes, rough, hilly country, traffic lights, stop streets, high temperature—all of these strive to bring your tires to an early grave, but it is to the credit of tire makers that tires today have much longer lives than those of yesterday.

Perhaps you have noticed that your tires wear very little in winter. Manufacturers have found that the rate of wear in summer is twice as great as in the winter. In fact, they consider it useless to operate test cars in winter in the north, because the wear on icy and snow-covered roads is not rapid enough. Wet pavements, too, do not wear tires rapidly because the water acts as a lubricant. About the only precautions to take in winter driving are to see that the chains do not bind and cut your tires, and to maintain proper air pressure.

Spotty or "scalloped" tread wear, indicated by a series of worn spots about the circumference of a tire, is usually caused by a number of factors working together. Underinflation usually starts it, and the trouble is aggravated by looseness in wheel bearings and steering mechanism. Wobbly wheels are sometimes the cause.



The remedy is threefold. First, check

your inflation when you notice this type of wear. Second, tighten wheel bearings, and bearings and joints in the steering equipment so that all play is removed. Third, switch the affected tires about so that they rotate in the opposite direction.

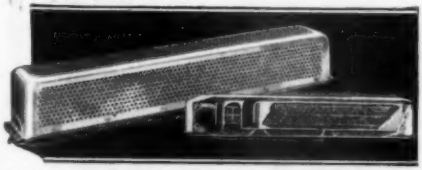
Spotty wear is a disease common to front wheels only, and the switching of front and rear tires sometimes is advisable, after the causes of the trouble have been removed.

EARTHQUAKE BREAKS CABLES ON BOTTOM OF ATLANTIC

Undersea landslides, set in motion by the earthquake off the Atlantic coast on November 18, were blamed for breaks in the transatlantic cables by officials of the U. S. coast and geodetic survey. The quake is believed to have occurred deep under the ocean bed and to have spread over a large area. The ocean bottom where the tremors centered has a steep slope, and landslides down these submarine slopes snapped the cables, officials believe. The earth quivered sufficiently, it was estimated, to cause a perceptible shaking over 1,500,000 square miles of land and 200,000 square miles of sea.

FORCED-DRAFT WATER HEATER FOR REAR OF CAR

Providing clean, odorless heat circulated through the car by motor and blower, a forced-draft hot-water heater for the automobile now is on the market. Instead of bringing cold air from outside the car, the heater uses preheated air from inside the car, insuring quicker action and greater heat. It is designed for front or rear-compartment installation



A Forced-Draft Hot-Water Heater for Either Front or Rear Compartment of the Automobile

and is placed on the floorboard so that it directs heat upward or along the floor of the car as desired.

EXERCISER LIKE BIG TRICYCLE GIVES EFFECT OF ROWING

Exercising Machine, Resembling a Tricycle, Which Gives Effect of Rowing When Propelled

Somewhat resembling a huge tricycle, but giving much of the effect of rowing when in use, an exercising machine which brings all the muscles of the body into play now is on the market. The weight of the body and a slight downward pressure on the pedals keep the exerciser in motion on level ground, and between each up and down dip of the pedals, about seven inches, the machine travels approximately fifteen feet and a speed of twenty miles an hour is possible. The operator takes his position in the saddle, his body somewhat crouched and grips the handlebars, then exerts pressure on the pedals, at the same time raising the body and extending the legs while pulling on the handles. This action sends the vehicle forward, but the crank arrangement under the saddle automatically lowers the body, bringing it into position for the next propulsion. For indoor use, a stand is provided on which the machine rests, and while it is stationary, all the effects of the vehicle in motion are possible. A smaller model is made for children.

Front of Cabinet Showing Effect of Motion, and Lid Raised to Illustrate How Display Is Arranged

FLEXIBLE MIRROR SIGN GIVES LIFE TO WINDOW DISPLAY

Pliers open and close, bottles become tall and then short, dolls dance and other mysterious things happen in an attractive window-display sign now on the market. It consists of a cabinet in which is a flexible metal mirror that bends by the rotation of eccentrics on a shaft driven by a small electric motor. The objects to be displayed are placed on a glass shelf at the top of the cabinet and are reflected by the moving mirror so that they appear to change size and position, although, in reality, they remain fixed. The mechanism, the shelf and the lights that illuminate the interior of the box are all invisible to the spectator, who sees nothing but the oddly moving group of objects or the sign, through the glass panel at the front of the cabinet. The box is suited to the display of a wide variety of articles and of pictures and drawings. To produce unusual backgrounds, colored papers or other materials are laid over the shelf at the top. A special feature of the outfit is that the letters may be made from interlocking metal stencils of the usual kind. The connections are invisible when the lights are turned on.

ELECTRICITY PRODUCES FEVER TO FIGHT DISEASE

Electricity has been used successfully in inducing an artificial fever in some patients suffering from ills which are combated by fever, notably paresis. The use of fever in treating certain diseases is based on the theory that fever is one of the major defensive measures of the body against invading organisms. Previously malaria had been used to produce fever but recently doctors have raised temperatures by using an electric current from a diathermy machine which was found to give better control of the degree and duration of the fever.

PHONOGRAPH UNIT FOR RADIO CHANGES OWN RECORDS

Phonograph records are changed automatically and played through the radio loud speaker by an electrically operated unit now on the market. It is also a complete phonograph in itself, having its own power pack and speaker in a cabinet. It has a capacity of fifteen records and keeps playing and changing them without further attention after it is started.

Close View of the Record Player, Which May Be Used with the Radio or as a Separate Instrument

HELICOPTER PLANE PASSES SUCCESSFUL TESTS

Man's dream of an airplane that will rise or descend vertically has expressed itself in many forms and one of the latest is an interesting all-metal plane with two twenty-foot propellers under the wing. They are driven by a 150-horsepower motor in the fuselage and revolve in a direction at right angles to that of the front propeller, which furnishes the forward power for the craft. On a test flight, the pilot was able to take the ship off after a run of but seventy-five feet, an unusual performance for a plane of this size and weight. He then quickly gained an altitude of 600 feet in short, steep climbs. At 6,000 feet, with both the under-wing propellers going at full speed, he found that the plane was under satisfactory control in all positions and under all conditions. The lifting propellers, giving an upward pull, also afforded greater stability, it was reported. The ship represents the results of more than four years of experimenting and further improvements in it are being made.

Helicopter Plane in Flight, Showing Position of the Propellers under the Wings, and Closer Views of the Craft; the Lifting Propellers Are Operated by a 150-Horsepower Motor in the Fuselage

CLOCK OPERATED BY SUNSHINE

In the observatory at Sydney, Australia, is a clock that apparently never can register incorrect time as long as the sun is shining on it, for the light from the sun operates it. Sunlight shining through a pinpoint falls on a scale which is geared to hands in such a manner that they register the time on the face of the clock to fractions of a minute. Several years of testing have revealed no inaccuracy.

Jumping into

By DON GLASSMAN

THE Caterpillar Club, that famous society of self-saved men and women, initiated about seventy-five persons during 1929. Membership toward the close of the year approximated 200.

Since the first two "Caterpillars," John A. Boettner and Henry Wacker, were initiated in 1919, this marks the tenth anniversary of the society's existence, although its official charter was not framed or the name conceived until 1922.

In October, 1929, Harry Sievers, pilot on the Cleveland-Pittsburgh air-mail express, left Bettis field, Pittsburgh, with an airworthy plane. Near Beaver Falls, his motor coughed, then stopped. He saw that he would be forced to abandon the ship, but he was loath to leave the mail where it might be consumed by fire. Seizing it with one hand, he dived into space, and pulled the rip-cord ring with the other. The chute boomed open. The conscientious mail pilot grounded safely and handed his pouch to the postal authorities.

During the same month, Lieut. John Seligman was flying a Vought-Corsair near Freeport, Long Island, when the plane wheeled and started a tail-spin at about 8,000 feet. For 5,000 feet, Lieutenant Seligman fought with the controls, but the ship danced like an uncontrollable bull. Convinced he would have to jump, Lieutenant Seligman, at 3,000 feet, threw himself into the void and landed about three miles from the point where the wrecked ship fell.

A few months before Lieutenant Seligman's adventure, two naval flyers, Chief Radio Electrician O. E. Williams and Comm. O. W. Erickson, chief inspector at the naval aircraft factory, were drop-testing parachutes over Mustin field, near Philadelphia.

"We had made twenty-nine short flights," said Williams, "when things began to happen. Approaching the field, everything was functioning beautifully, and the fifty-ninth parachute was released. Less than four seconds later, one blade of the three-bladed metal propeller broke, causing excessive vibration of the whole plane, tearing the power unit from the barriers and dropping it into the field, burying itself under five feet of sod."

A blinding flash of fire and smoke rose before them. A dull muffled noise sounded as though someone had tried to smother the motor and propeller with a heavy blanket.

Twelve Officers and Enlisted Men of the Naval Air Station at Anacostia Boarding a Tri-Motored Ford Plane for a Demonstration Jump during Navy Day Celebration

"I first thought the plane had burst into flames, but only a moment elapsed before this condition cleared and the motor dropped out. The plane was thrown around ninety degrees to the right, and began to fall with the tail dangerously low. The adjustable stabilizer was all the way up, which increased our danger. At the time I jumped, Commander Erickson was making every possible effort to get the stabilizer down. Seeing that my weight on the tail jeopardized his efforts, and knowing the plane was starting to spin, I yelled, 'I am going to jump!' Noting the position of brace wires and the tail, I engineered my exit by sliding down the side of the fuselage with my hands—the altitude at this moment was a good 600 feet. Dropping clear, I waited for a good safe margin of ship clearance, then pulled the parachute rip cord. I experienced no unusual jerk or sensation. I landed on my heels in a field and gave way to a sitting position in order better to collapse the chute."

Commander Erickson's motto was, "Don't give up the ship." After Williams had jumped, he managed to bring up the tail and piloted the motorless bomber to a safe landing.

Another recent jump was made near Islip, Long Island, by Lieut. Richard H. Magee, attached to Mitchell field. Lieut. William C. Thomas, pilot, and Magee, machine gunner, were pursuing a "sleeve" target towed by another airplane. Lieutenant Thomas suddenly felt torrid waves of heat coming from the engine. It was overheated and stalled.

"Jump!" the pilot commanded Magee, thinking he would be unable to make a safe landing. The altimeter registered 2,000 feet. Magee waited for about 500 feet before stepping off. The pilot remained at his controls and brought the "Falcon" biplane down in a swamp. Lieutenant Magee made a skillful water landing in Great Neck bay. Detached from his parachute, he managed to swim until he was rescued by a rowboat.

While flying an "F-3-B," Lieut. P. M. Clyde, navy flyer, lost control of his spinning plane and was forced to jump. Just as he opened his parachute, he received

Composite Photograph Showing Six Jumpers in the Air at One Time, Members of the Royal Air Force in England Staging a Parachute Exhibition, and Close View of Flyer Showing How the Seat Pack Is Worn; Cases of Parachute Failures Are Now Almost Unknown

a vicious blow on the right shoulder from a wing. It disabled his right arm. Nine hundred feet below him lay the ocean, and while he dropped about sixteen feet per second, he managed to kick off his boots and unsnap his parachute harness before striking the water. He fell into the ocean about four miles off North Island and was picked out by a navy barge.

Richard Bowman, pilot for the Pacific Air Transport company, was flying his regular run between Los Angeles and points north. The night was dark and sticky. He saw the glimmering bulbs of the city fade in low-hanging mist until they resembled strands of lacework. The clouds were piled in thick layers as he headed for the Tehachapi range. He edged in between two canyons of mist and rushed down a black corridor in the direction of Bakersfield.

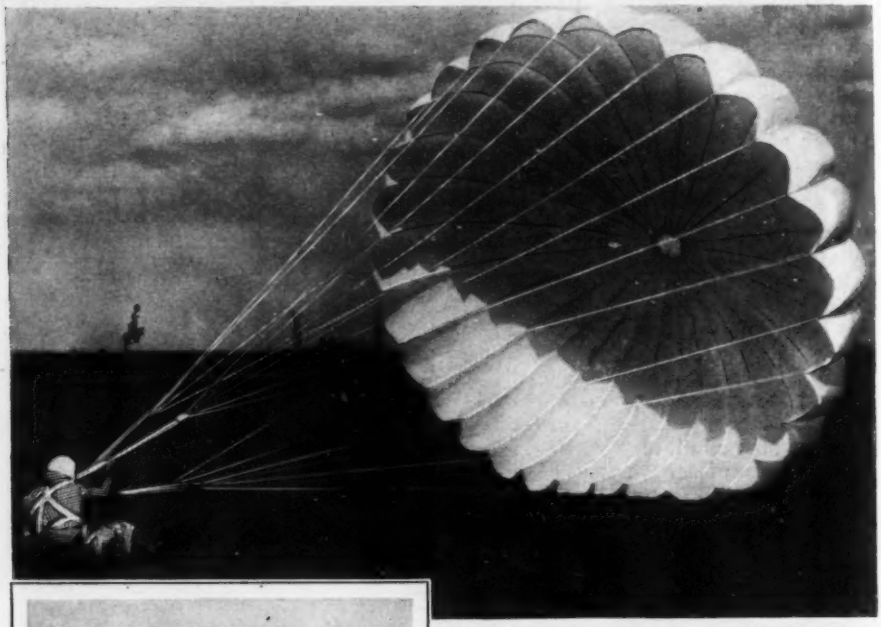
Big Chute for Supporting Airplanes Partly Inflated, and Young Woman Parachute Student with Hand on the Releasing Ring

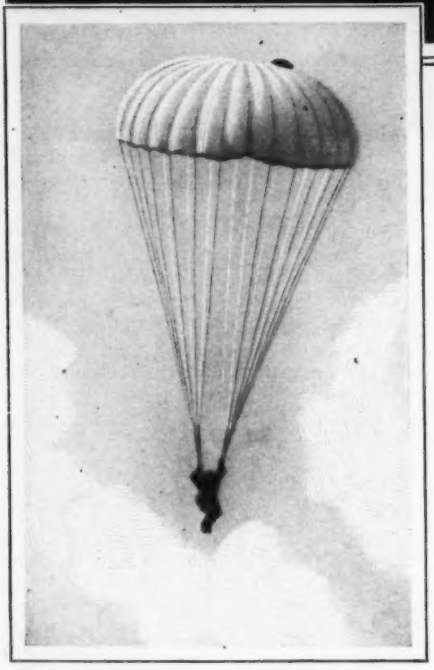
Composite Photograph Showing Six Jumpers in the Air at One Time, Members of the Royal Air Force in England Staging ... Showing How the Seat Pack Is Worn; Cases of Parachute Failures Are Now Almost Unknown

For an hour, the pilot fought buffeting winds. The plane side-slipped and skidded. The propeller churned in soggy mist, and Bowman kept an even keel only by relying on his intuition and the illuminated dashboard.

When his instruments gave warning signals, he sensed that the ship had thrown a fit and was beginning to whirl into what seemed to be an outside spin. Not a light shone from earth. The transport did not show the slightest inclination of coming out of the spin.

Bowman could not describe the exact nature of the ship's maneuver, as he was thrown off by centrifugal force and thrust into the blackest of nights. His landing came surprisingly easy. He found himself on a mountain ledge, apparently the only place within ten miles where a parachutist could have grounded without injury. He built a fire and sat beside it





Landing after a Successful Test of an Automatic Parachute Release for Passengers, and Close View of an Easy Descent

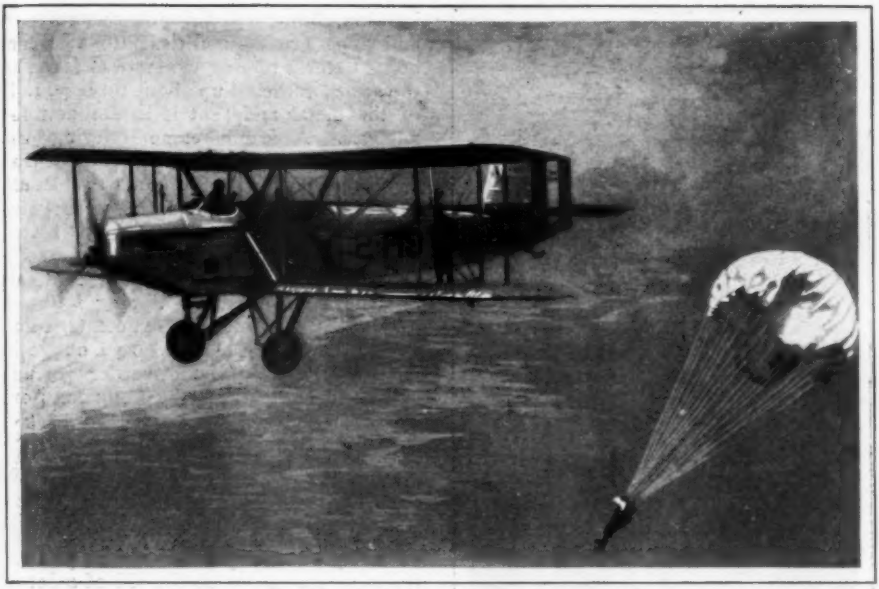
until morning, when he slid and crawled over crags until he reached a road.

While testing a new monoplane near Alexandria, Va., Temple N. Joyce, purposely drove it into a left spin in order to learn its recovering characteristics. "After a few turns," said Joyce, "it became apparent that the plane would be difficult to recover. I immediately gave full opposite controls. Instead of responding, the attitude of the plane became increasingly flat. After 2,500 to 3,000 feet of spinning and several futile attempts to use the gun, I resolved to abandon the ship.

"The centrifugal force in a flat spin is generally very great and acts to rearward. In this spin, I was pinned so tightly against the back of the cockpit that the parachute caught under the leather padding of the cowl when I attempted to stand up. This delayed my exit for about 500 feet. Finally I abandoned this attempt and rolled over the left side, hoping to peel the parachute from under the padding.

"It worked.

"After clearing the plane and pulling the rip cord, the chute opened with little



One in the Air and Another on the Wing Ready for the Jump into Space; Navy Flyers Taking Parachute Tests, an Important Detail of the Army and Navy Flying Regulations

jar. I floated within seventy-five feet of the spinning plane—too close for comfort.

"A few moments later the plane crashed; I landed in a tree without bruise or injury.

"I think this is the first record of anyone jumping safely from a spinning plane, and I am sure it was the first time it was accomplished from a flat spin."

On April 14, 1929, Lieut. Shapley Gray and Capt. William Wimer left Jefferson City, Mo., headed for St. Louis.

"I was flying over the Missouri river, watching the shoreline over the right side to avoid the bluffs," said Captain Wimer, "when the motor quit. I turned to the right to get over land and yelled to Gray, 'Take to your chute!'

"Gray was up on the edge of the rear cockpit with one leg over the side; he paused long enough to pull off his gauntlets and throw them back into the ship.

"Then I got busy. By the time I had got out on the left wing, the ship had nosed down and lost considerable altitude. I sensed rather than gauged the distance between me and the approaching trees.

"I decided to trust a 'pull-off.' I held the center-section strut with my left hand and made a grab for the rip cord with the right. I missed. I released my hold on the ship, grabbed the harness with my left hand and pulled it out in front of me so I could see the ring.

"I pulled it. The chute opened.

"I felt one oscillation only, and the next thing I knew I was suspended far above ground, between two trees, with my chute caught in the topmost branches of one of them. I could not reach either tree and I was afraid to swing myself over to one as I could not see how securely the chute was fastened. I had visions of the darn thing slipping and dropping.

"Finally, I managed to swing around. I touched a twig, and pulled myself, hand over hand, toward larger branches. I released the chute, and there I was fifty feet from ground, marooned like a squirrel.

"I began to slide down the trunk, and had traveled about thirty feet when I struck a knot in the tree which broke my hold. I fell the rest of the way. Luckily I landed on my seat in marshy ground overgrown with willows and cat-tails.

"I tried to locate my buddy, but he was not found until the next morning. His chute was still in the pack and the rip cord in its pocket."

Architect's Drawing of World's Tallest Building, a 100-Story Skyscraper for New York

HUNDRED-STORY SKYSCRAPER TO BE SERIES OF TOWERS

Planned to dominate the entire city of New York when completed, the first one-hundred-story skyscraper is to be erected in Madison Square. The structure will consist of a series of set-back towers, piled one upon the other, and will be the world's tallest building. It will house the 30,000 employes of the Metropolitan Life Insurance company.

PROSPECTORS DISCARD METAL COSTLIER THAN GOLD

Three prospectors searching for gold in New Guinea recently threw away hundreds of pounds of a metal worth ten times more than the gold they sought, and were unable to recover the discarded fortune. While sluicing for gold, they found a quantity of blue-gray metal which appeared as heavy as the gold they were hunting, but they did not recognize it and flung great quantities into a stream bed. Later a mining expert was taken to the scene, gathered up about three pounds of the metal and sent it to London for analysis. A cable came offering the miners a price ten times higher than that paid for gold for all the metal they could produce. It was osmiridium, a rare mineral containing the two closely related elements of osmium and iridium. It is among the heaviest and hardest metals known and is used for tipping fountain pens and for scientific instruments, being valued at from $200 to $300 an ounce in the crude state. The discarded fortune had been washed away by the waters except for a few scraps.

BLOCKS HELP TEACH CHILDREN FOREIGN LANGUAGES

Children are taught many of the words of foreign languages in an easy and interesting manner with the aid of a set of blocks now on the market. Each unit has different interchangeable words on the faces so that new combinations appear as the blocks are turned. With only four blocks, more than 200 variations are possible. The units are numbered and a vocabulary with translation is provided with each set in addition to a key for a guide to sentence formation. Another feature is that masculine words are printed in red and the feminine in blue, to aid the young student.

Learning a Foreign Language with Aid of Blocks Painted with Interchangeable Words

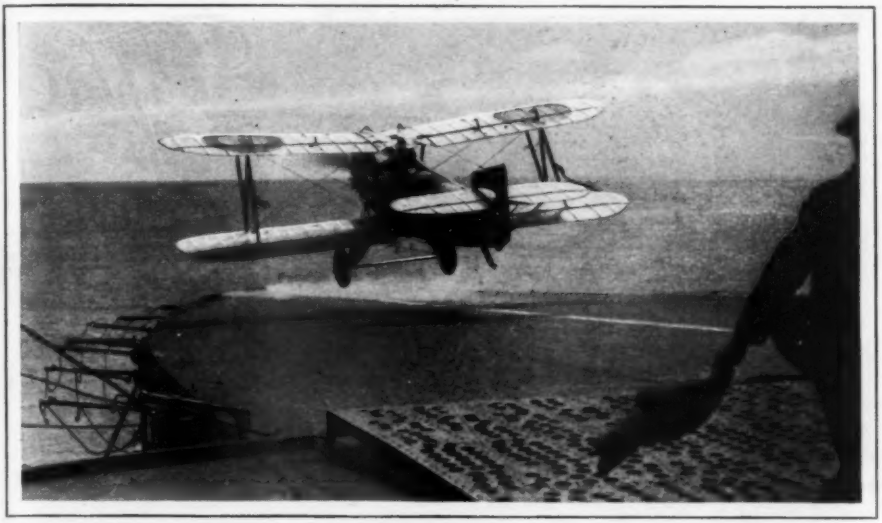


Photo by Central Press

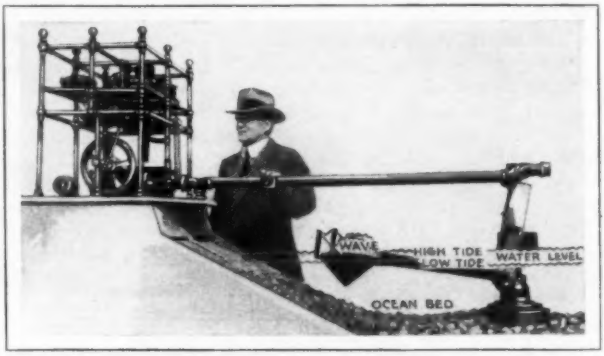
Plane Leaving a Ship, Its Take-Off Aided by the Steam Jet in the Bows Which Indicates the Angle to Face the Wind When the Jet Coincides with the White Line the Plane Follows

JET OF STEAM AIDS AIRPLANE TAKE-OFF FROM SHIP

To show the correct angle for a seaplane to take off from the deck of a British battleship, a steam jet was played along a white line on the deck during recent maneuvers in the Mediterranean. The vessel first ran head into the wind, then from the bows the steam blew along the deck until it exactly coincided with the white line which the plane followed in leaving the ship, thus giving it the correct angle to face the wind.

MOTOR RUN BY WAVES OF SEA OFFERS CHEAP POWER

Converting the motion of the waves of the sea into usable electrical energy is accomplished by an ocean-wave motor, a model of which has been demonstrated successfully by its inventor. The motor records every impulse of the water due to wave motion, including roll, weight of the water, tide and undertow from any direction. The apparatus consists of a float attached under water to two swinging arms. The waves rolling onto the flat top of the float force it down, and the motion thus created is translated into power by mechanism all of which is above water. The float resets automatically for the next wave. The inventor claims that it is practicable to install batteries of these motors along the seashore to provide cheap power for all seaside communities.



Model of Ocean-Wave Motor Intended to Convert Wave Energy into Electric Power for Commercial Purposes

A Pair of Prospectors, Landed on an Unnamed Lake by Airplane, Ready to Start the Hunt for Gold; Two Weeks Later the Plane Returns to the Rendezvous to Pick Up Samples and Land Supplies

PART III

THE FIRST week in August a wireless message out of the land of the northern lights, sputtering in a dah-dah dit-dit-dah of dots and dashes, came from a little ship anchored in the northeastern arm of Bathurst inlet, at the eastern end of Coronation gulf, 200 miles east of the Coppermine river, and just south of Victoria island, in the Arctic sea.

Stations down along the rim of civilization picked it up, and relayed it back to a radio operator at Baker lake, far up in the Barren Lands, to make sure he had not missed it. The message read:

"Number Two Gas Cache Ready."

Three planes were waiting at Baker lake for just that word. Weeks before, the same radio chain had brought a similar message, with the word "One" instead of "Two," and sent from the mouth of the Coppermine, far to the east of Alaska. The three ships, a Loening amphibian, a Fokker and a Fairchild, the latter two on seaplane pontoons, had come in on the heels of the ice break-up, flying from Sioux Lookout, just north of Lake Superior, by way of the western shore of Hudson bay, past Fort Nelson and Fort Churchill, Cape Eskimo to Fort Chesterfield, where they turned westward up Chesterfield inlet and out over the Barren Lands to Baker lake.

The next day, the three took off and winged northwest over 400 miles of unexplored and unmapped territory, assured that fuel and supplies were waiting them on the rim of the Arctic sea. At the controls of one ship was C. A. "Duke" Schiller, hero of the spectacular rescue of the "Bremen" flyers at Greenly island. J. D. Vance flew the Fokker and Tom Reid the Fairchild. All three were war-time pilots in France.

With them went the last frontier, moving back until it disappeared among the arctic islands. With two gasoline caches planted above the Barren Lands, every point in Canada, from the Ungava coast opposite Greenland to the Alaska border and from the United States to the polar sea is within two days of the end of steel.

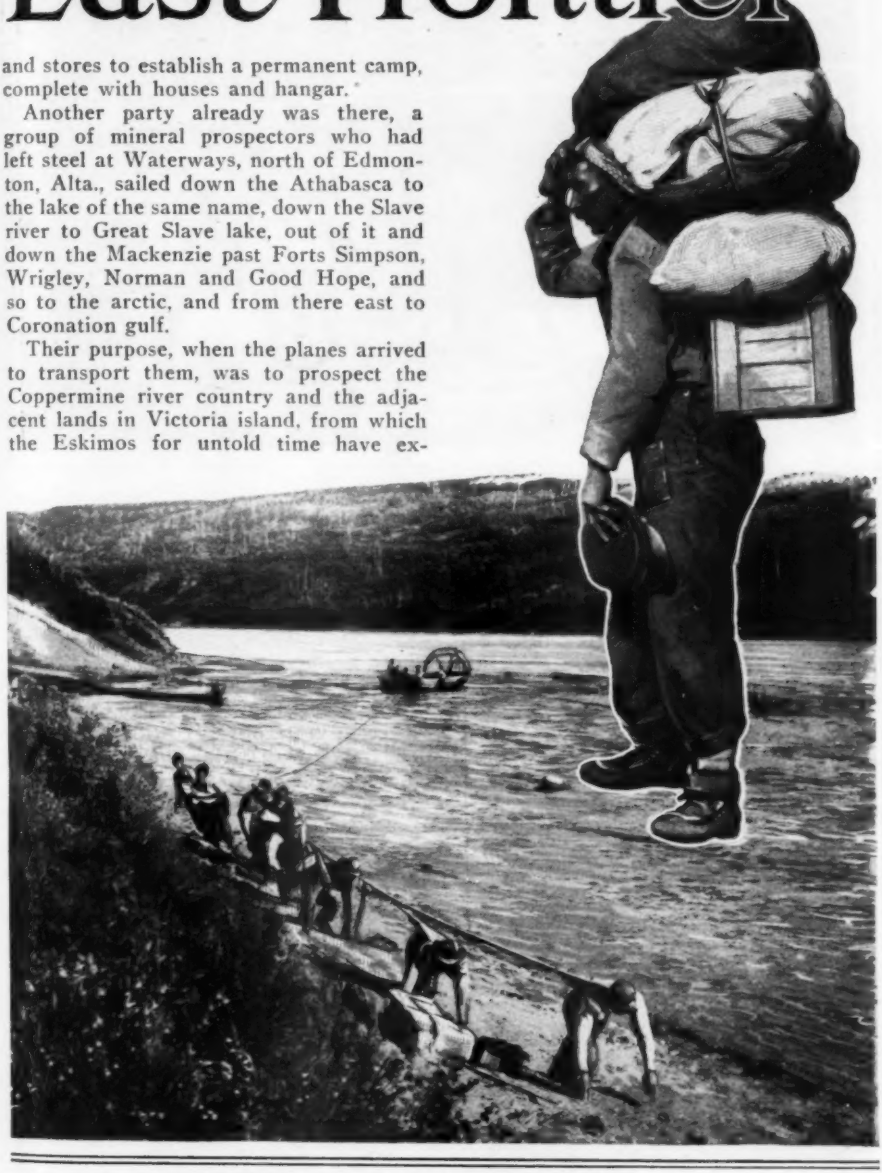
From Bathurst inlet, the three flew on in company to the mouth of the Coppermine, where the supply ship, starting from Vancouver in the early spring, had put down the first cache and landed lumber

Last Frontier

and stores to establish a permanent camp, complete with houses and hangar.

Another party already was there, a group of mineral prospectors who had left steel at Waterways, north of Edmonton, Alta., sailed down the Athabasca to the lake of the same name, down the Slave river to Great Slave lake, out of it and down the Mackenzie past Forts Simpson, Wrigley, Norman and Good Hope, and so to the arctic, and from there east to Coronation gulf.

Their purpose, when the planes arrived to transport them, was to prospect the Coppermine river country and the adjacent lands in Victoria island, from which the Eskimos for untold time have ex-



Airplanes Have Done Much to Take the Toil Out of Prospecting, Ending Scenes Like These; at the Top Is a Prospector Headed for Flin Flon, and, Below, Indians "Lining" a Barge up the Peace River Rapids

Men Have Carried 600-Pound Weights in the North, and Two Oil Barrels Are No Load for an Indian; Top, a Prospecting Party in the Bush

tracted vast quantities of virgin copper. Their hope was to uncover another great copper-mining center which would rival Calumet, in Michigan, and the Anaconda country, in Montana. If they succeed, plans are already being laid for a new arctic railroad, a road 400 miles long whose southern terminal, on Great Slave lake, at either Fort Rae or Fort Reliance, will be hundreds of miles north of the end of steel at Waterways. It will be a mining road linked with civilization by nearly a thousand miles of waterways.

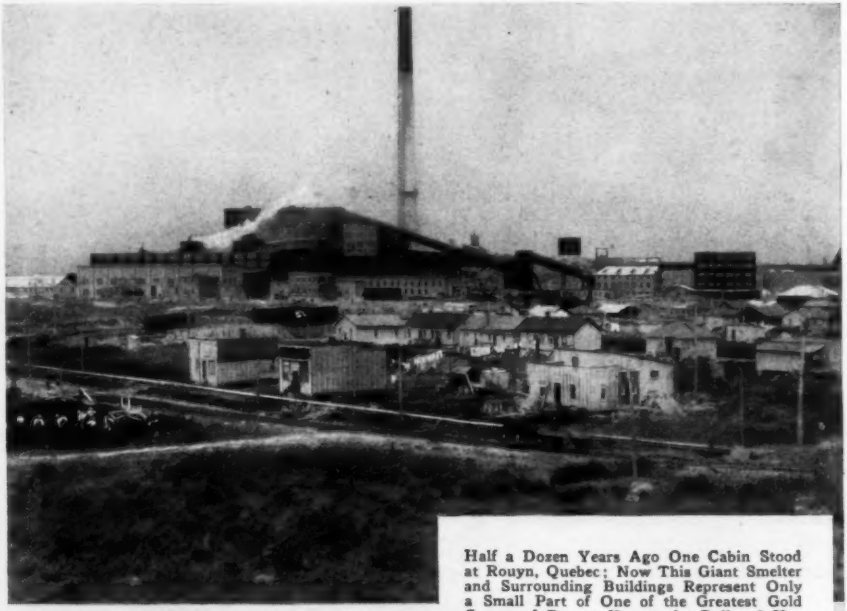
Two or three years ago, the proponent of such a scheme would have been thought crazy; today, with all the north opened up by airplanes, anything is regarded as possible. Vast distances have ceased to terrify. Instead of being months away, the most distant points have been brought to just over the horizon. A week suffices to go to the mouth of the Coppermine and back, starting from New York or Chicago.

Show a big enough ore body to warrant it, and the railroads, both the Canadian Pacific and the Canadian National, are ready to push ahead almost any distance beyond their present ends of steel and furnish transportation. It has only been four or five years since depression was so general throughout Canada that

Moose Factory, the Hudson's Bay Company's Post on James Bay, in Winter; the Two Planes Are Part of a N. A. M. E. Expedition to the Belcher Islands, Where Rich Iron Claims Were Staked

Here's the Way to Carry a Sixteen-Foot Canoe on Portage; in the Background Is the Load of Supplies; Some Portages between Lakes Are Only a Few Steps, and Occasionally One Measures Several Miles; the First Party Each Spring Has the Difficult Task of Clearing Away Fallen Trees and Opening the Trail

The Water Company of the North Requires No Pipe Lines or Pumping Plant; This Crude Drag, with Its Ox for Motive Power, Is the Hudson's Bay Company Waterworks at Cumberland House, a Famous Post West of The Pas in Saskatchewan



Half a Dozen Years Ago One Cabin Stood at Rouyn, Quebec; Now This Giant Smelter and Surrounding Buildings Represent Only a Small Part of One of the Greatest Gold Camps of Recent Years; the Railroad Has Pushed into Rouyn, Supplanting the First Aerial Gold-Mine Service; Below, the Second Busiest Airport in North America, Sioux Lookout, a Bush Village at the Gateway to the North

They Had No Space-Devouring Airplanes When This Black Ribbon of Men Toiled up Chilkoot Pass and Down into the Yukon on Their Way to Dawson and the Gold Camps; This Photo Was Taken in 1898

many Canadians themselves lacked confidence in the future of the country. All that is changed now, and both confidence and the money to back it are available to go any place and do anything.

As late as 1926, a rich group of claims, only a hundred miles or so northwest of The Pas, were allowed to lapse because no one saw any prospect of getting transportation, and without machinery to build a mill, the mines could not be worked. That group, restaked, now forms the Sheritt-Gordon mines, only a few miles beyond the end of the Flin Flon mining railroad branch, and within easy reach of track extension. Two million dollars already is being spent on development there, and when the railroad gets in, millions more will be invested.

Even without a railroad, it has been discovered, mines can be built and developed. The Howey mine at Red lake, the original discovery claim that started the stampede in the winter of 1925-26, will have its mill completed before this appears in print, will have power wired in from a hydroelectric plant which has been rushed to completion at a power site more than sixty miles away, and had a shaft down a thousand feet last July. Marine railways across the portages made that possible, for the railway is still nearly 150 miles away, by boat, and 100 miles by air. The mill equipment went in by scows. At each portage, the marine railway hauled the scows out of the water, across the land bridge, and dropped them into the next lake.

In winter, when the lakes freeze, giant endless-tread tractors take the place of both scows and marine railways. Hauling six or eight tons on their own bodies and dragging long sled trains with forty to sixty tons more, they plow through snow and over the ice, hour after hour, on exact schedule, and transport supplies at costs easily comparable with railroad freight rates.

Tractor trains were first introduced in the north to get building material and food and supply caches strung along the right of way, so that work on the Flin Flon railroad could open promptly with the beginning of spring. They proved their worth and were tried on the Hudson Bay road, which was being pushed north to

A Scene to Make a "High Grader" Happy; Rich Silver Vein on the 700-Foot Level of the Concarum Mine, at Schumaker, Ontario

Fort Churchill, and they were used to move a great part of the original projected railroad terminus at Fort Nelson north to the new site at Churchill.

Winter camps were established along the road to house the crews, and the tractors ran constantly, twenty-four hours a day, which prevented their engines freezing. Crews were changed every eight hours, but in some cases the engines themselves ran steadily for weeks without a halt. They made endurance records that set marks for later airplane pilots, with refueling contests, to shoot at.

The history of Canadian mining, while it goes back more than three-quarters of a century, is really concentrated, so far as the more precious minerals go and so far as quantity production is concerned, within the last quarter century, if you leave out of consideration the Klondike and other discoveries in the Yukon. The modern mining boom really started with the Cobalt field, a famous silver camp, in 1905. It has been claimed that only $600 was invested in the original Cobalt discovery. Cobalt, Porcupine, Kirkland lake, Timmons, Rouyn, and now Red lake, Flin Flon, Cold lake and Rottenstone are largely responsible for putting mining third among Canadian industries, exceeded, in value of output, only by agriculture and forestry. The Dominion rates first among the nations of the world in the output of nickel and asbestos, second in cobalt, third in gold, third in silver, fourth in lead and copper, and sixth in zinc. The copper output is growing so rapidly that Canada is soon expected to be in third place, exceeding Africa and surpassed only by the United States and Chile.

While the great camps and the famous mines, such as the Hollinger, at Timmons, and the Teck Hughes and McIntyre—the three biggest producers in the Dominion—are fairly limited, there are dozens of other camps in which transportation and money for development may produce names that will be as famous in the future.

Big business, with the advent of the airplane and modern methods, is displacing the old free-lance prospector and going at the conquest of the north in such a systematic manner that it is only a question of time until every square mile of possible mineral territory will have been examined.

Much of the romance of the north, with its canoe and dog-team trails, may pass with the aerial conquest, but at least the life in the bush has been made more pleasant, and more safe. Not a single pros-

Tractors Are Doing for the North What Airplanes Have Done in the Sky; Where Horses Cannot Live, They Solve the Ground Transportation Problem

pector was killed nor a pound of freight lost by any of the air lines in 1928 and the first half of 1929, while some forty prospectors were reported to have been drowned or lost on the trail during the same period. The perfect record for transportation of supplies is one thing that commends aerial progress to the miners, for, in shipping by canoe, it is customary to lose an average of one-fourth of all goods in the rapids and on portages.

Even the safety record of the airplanes, however, has not taken all the danger out of life in the far north. Two N. A. M. E. prospectors met with misfortune in the Barren Lands in October of 1928, one losing his life on the trail and the other being so badly frozen that both legs had to be amputated. The two had been prospecting northwest of Baker lake, and their plane was to return on a fixed date. That day a blizzard blew up, and for three days no planes could get into the air. Becoming alarmed, the two left their camp and started to walk out. One froze to death, and, after nine days' walking, the other reached the base camp with both legs frozen. The plane had flown in to their abandoned camp on the fourth day after the blizzard ended, and, if they had waited there, both would have been rescued.

The survivor, Tom Cowan, was a veteran of the north. Forty years ago he was a jockey on American tracks, but for more than a quarter of a century he has roamed the bush in canoes and behind dog teams. Last August, with a pair of crutches to supplement his artificial legs, he had flown in to Sioux Lookout to inspect some claims in which he has an interest. As he climbed out of the ship on his return, his only remark was that he was the "first wooden-legged man to fly into the north."

It is men of that stamp that have pushed the frontier back until it has been lost in the polar seas.

The completion of the Hudson Bay railroad, in September, is expected to lend speed to the civilization of the arctic. Projected as a grain carrier, to move wheat from the prairie provinces to Fort Churchill, where steamers could take the load over a shorter route to Liverpool, the Hudson Bay road now promises to be so important to the mining industry that grain carrying will only be a side line.

Men of vision have all sorts of plans for its future use. N. A. M. E. last winter sent an expedition up the eastern side of Hudson bay as far as the Great Whale river and established camps and gas caches all along the route, then flew out over the bay and staked five miles of iron claims in the Belcher islands.

What anyone wanted with five miles of even fabulously rich iron claims on an isolated group of islands in icy Hudson Bay was a puzzle to many people, but, as a matter of fact, they are linked quite di-

rectly to the development of the Hudson bay railroad into Churchill, hundreds of miles away.

One of the unsolved problems of the bay railroad has been what the wheat boats could carry westward as return cargo from England. The only bulk cargo suggested has been Welsh coal, and if coal was brought, the only outlet would have been down through the prairie provinces, which are developing quite satisfactory coal mines of their own.

But it is possible that coal from Wales may be coked at Fort Churchill and used there to smelt Belcher island iron, brought across the bay by boat, and so turned into steel. With coal carried at a low rate as a return cargo, and the iron ore hauled a relatively short distance from the islands, Churchill may in time be a great northern steel-making center.

Canada has great plans for Churchill, and is proceeding carefully with their development. To avert a land rush and uncalled-for speculation in frozen town sites, settlers have been barred. As all the north country for hundreds of miles has not been surveyed and remains crown lands, corresponding to the government domain in the western United States, settlers are easily barred. It is probable that Churchill may be developed as a government-owned town site, to keep speculators out and bring in only such people as are needed to work on the railroad, docks and warehouses, and to operate such stores as may be needed to supply their wants.

(To Be Continued Next Month)

RIVER OF LIQUID SUGAR FLOWS THROUGH PIPE LINES

To speed the time of delivery, sugar is now being distributed in liquid form through pipes instead of being handled in bags. At the refinery, a gravity pipe line conveys the liquid sugar to a tank car or truck and is hauled to the buyer's plant where it is again pumped to a distributing tank in any part of the building. The system is a result of the discovery of a carbon of high purifying quality, making possible the production of a white sirup, as refined as granulated sugar, directly from the raw material.

FILLING STATION LIKE PLANE ATTRACTS ATTENTION

Resembling a huge monoplane, a gasoline-filling station in Salt Lake City invariably attracts the attention of passing motorists. The cabin is used for the

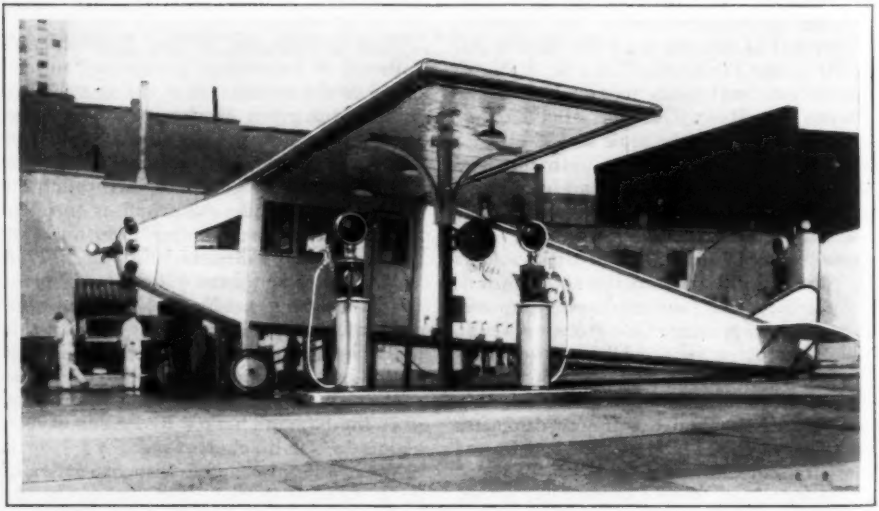


Photo by Ewing Galloway

Automobile Filling Station in the Form of an Airplane with the Wing Affording Shelter for Cars and Attendants; the Design Utilizes a Narrow Lot in Practical Manner

office and storage space, and the wings are built as a canopy over the drive on either side.

WILLOW BARK IS PEELED BY MACHINE

Willow wands used in basket weaving now may be peeled by machinery with an apparatus recently demonstrated in the willow-growing section of England where women and girls for many years have done the task by hand. The machine consists of a rapidly revolving drum with small spring forks on its surface. The willows are fed onto the drum in bundles through an aperture, the forks dragging off the bark as the wands are moved to and fro by the operator. The machine operates about five times as fast as the most expert willow workers.

FURNACE MADE OF FIREPLACE TO HEAT ENTIRE HOUSE

Transforming a fireplace into a furnace which heats the entire house instead of one room is accomplished with an apparatus employing an electric fan system below the floor on which the master fireplace is installed. The fireplace back is of corrugated iron and inclosed by a second metal jacket, leaving a space through which air is circulated by the fan. Radiating fins on the fire back project into the air space to speed heat absorption as cold air is forced over them. Distributing pipes below the floor convey heated air to registers in the various rooms.

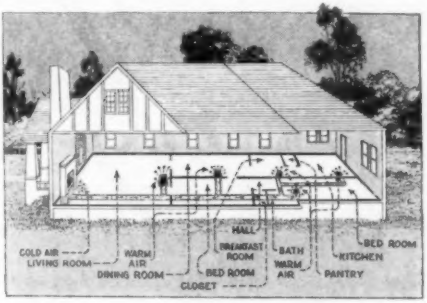
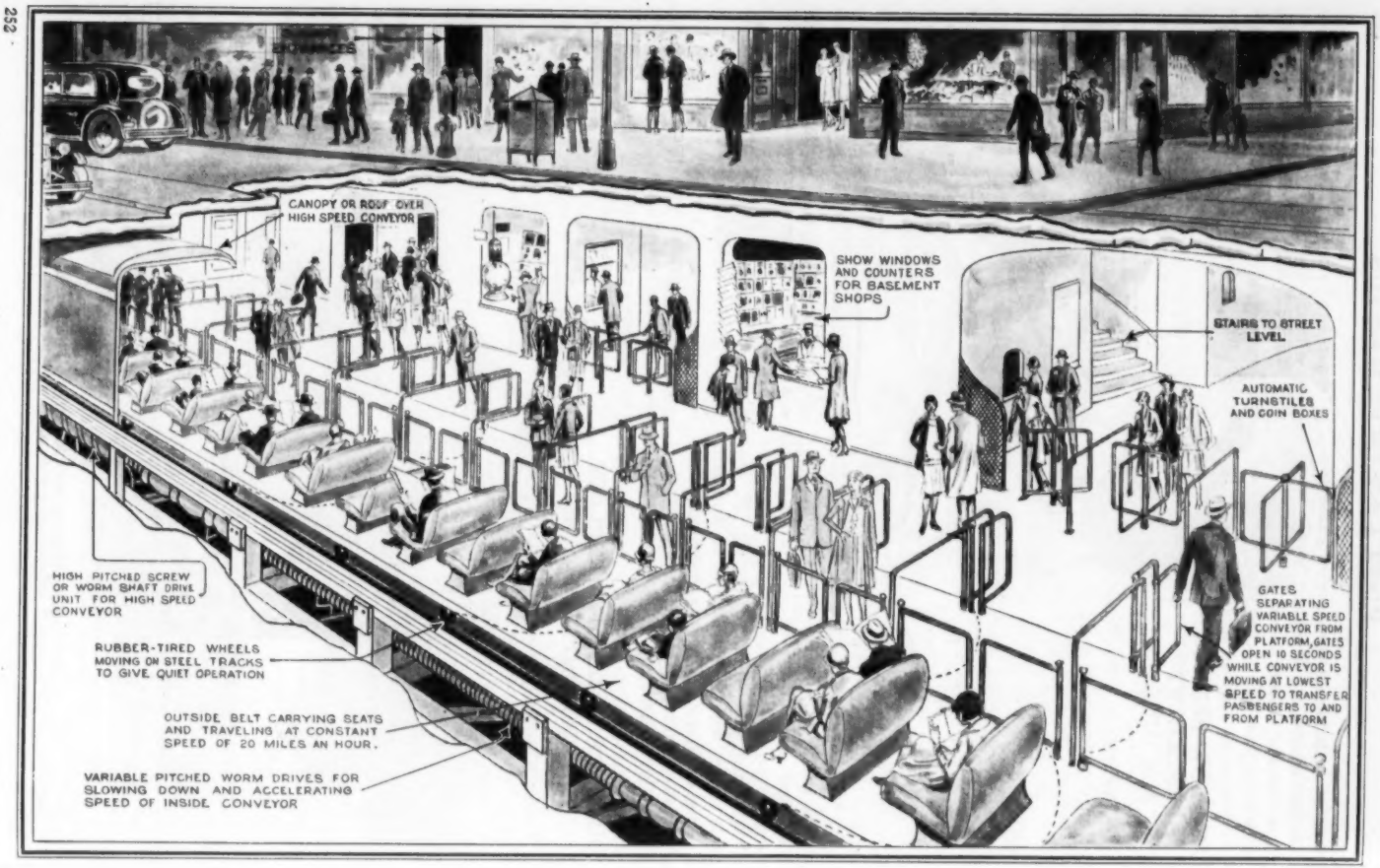


Diagram Showing How Heat from a Fireplace May Be Conveyed to Other Rooms of the House

Collapsible Desk for the Classroom Consisting of a Drawer and Six Flat Pieces; Children Are Able to Assemble It in Two Minutes

COLLAPSIBLE DESK FOR CHILD IS ADJUSTED TO SIZE

Intended primarily for use in the classroom, a collapsible desk for children which the pupil is able to assemble or take apart in two or three minutes now is available. It is made of six pieces, all flat except the rectangular hinged top box which forms the working surface. It provides a seat, a working surface and a hinged drawer and may be adjusted to the size of the child. The top may be locked to form a hand case for carrying to and from school, and above the desk is a rack for placing material to be copied, while the surface may contain a built-in blackboard if desired. Two setscrews are all the equipment needed to set up the desk, which weighs about fifteen pounds. Use of the desks enables rapid clearing of the classroom for play or other work, which is an obvious advantage.


CANOPY OR ROOF OVER HIGH SPEED CONVEYOR
SHOW WINDOWS AND COUNTERS FOR BASEMENT SHOPS
STAIRS TO STREET LEVEL
AUTOMATIC TURNSTILES AND COIN BOXES
HIGH PITCHED SCREW OR WORM SHAFT DRIVE UNIT FOR HIGH SPEED CONVEYOR
RUBBER-TIRED WHEELS MOVING ON STEEL TRACKS TO GIVE QUIET OPERATION
OUTSIDE BELT CARRYING SEATS AND TRAVELING AT CONSTANT SPEED OF 20 MILES AN HOUR.
VARIABLE PITCHED WORM DRIVES FOR SLOWING DOWN AND ACCELERATING SPEED OF INSIDE CONVEYOR
GATES SEPARATING VARIABLE SPEED CONVEYOR FROM PLATFORM, GATES OPEN 10 SECONDS WHILE CONVEYOR IS MOVING AT LOWEST SPEED TO TRANSFER PASSENGERS TO AND FROM PLATFORM

MOVING SIDEWALK MAY SOLVE RAPID-TRANSIT PROBLEMS

Possible solution of the rapid-transit problem of large cities is seen in a moving sidewalk, built on the principle of a belt conveyor, said to be capable of carrying 70,000 persons past a given point every hour at a speed of from twenty to twenty-five miles an hour. The sidewalk, either subway or elevated, makes no stops but enables passengers to alight with ease and safety. It is the invention of a Detroit man, and a model of the system now is in operation. It comprises two endless belts, one beside the other, each five feet wide and built in twelve-foot sections. Traveling on wheels and tracks, the sections are built as solidly as the modern trolley car, and fit into each other at the ends. The inner belt, separated from the outer by an endless succession of automatically controlled gates, moves uniformly at from twenty to twenty-five miles an hour, its outer edge forming an aisle and the inner containing seats. The outer belt consists of a platform separated from the stationary walk or platform by another succession of gates. This platform at intervals moves at a speed of less than a mile an hour, at which time the gates open to permit passengers to board it. In nine seconds it is accelerated to the same speed as the inner platform when the inner gates open to permit passengers to enter the constant-speed conveyance and take seats. The entire system would move in one direction on one side of a street, and in the opposite direction under the sidewalk on the other side. Construction and operation would be simpler and less expensive than a subway, it is claimed.

EXTRA LIGHT SPEEDS GROWTH OF SUGAR-BEET SEEDS

By the use of electric light, sugar-beet seeds can be produced in one year instead of the usual two, Prof. George Stewart, of the Utah agricultural experiment station, has discovered. He planted the seeds in greenhouses in November or early December and illuminated them after dark. The plants produced seed the same summer they were set out in the field.

Tempting the Insect-Eating Plant's Appetite with a Morsel of Meat; Note Cobralike Shape of Stems

PLANT THAT DEVOURS INSECTS TRAPS THEM WITH HONEY

One of nature's strangest products is a plant that represents a sort of cross between the vegetable and animal kingdoms. It contains honey-secreting cells which prove a lure to various insects, but as soon as they alight, the leaves close over them, and they are digested by the plant's juices. The blossom and stalk have a curious resemblance to the hooded cobra.

TONGUE CLEANER ON HANDLE OF TOOTHBRUSH

Cleaning the tongue as well as the teeth is made possible with a toothbrush which also contains a pad for brushing the tongue. This pad is on the end opposite the brush and consists of a spongy, round cushion which cleans by vacuum and contact without injury to the nerves of taste in the tongue.

BABY BUGGY RESEMBLING AUTO AFFORDS PROTECTION

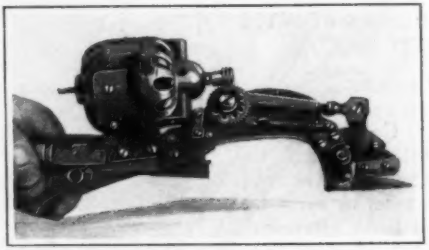
Baby Carriage Like an Automobile Body, Which Affords Complete Protection from the Weather

Affording complete protection from the weather to the youngster out for an airing, a baby carriage resembling an automobile body has made its appearance in London. The carriage is entirely inclosed, and has movable glass windows.

MEASURE FOR LIGHT IS FOUND AFTER TWENTY YEARS

For the first time in history, mankind has a way of measuring light with unvarying accuracy. Tomorrow all the artificial lights in the world could be destroyed, and the next day man could reproduce them to an exact standard. Yesterday, figuratively speaking, he could not have done so. He had no accurate means of measurement then. This remarkable contribution to man's constant trek away from darkness is the product of the bureau of standards after twenty years of research. The brilliance of pure platinum at the fusing point is the basis for the new standard which has supplanted the undependable comparison with a group of standard electric lamps which the bureau has guarded for a score of years as the "international candle." All the time they were changing in brilliance and could not be reproduced when their efficiency was seriously impaired. The first method of measuring illumination was by the candle standard from which is derived the common term candlepower. It is a virtual impossibility to reproduce a candle with the precision that science demands and just as difficult to make it behave in the way its predecessor did. The oil-lamp standards succeeded that first elastic yardstick. Their performance was affected and subjected to a change by a host of factors. Then came the electric-lamp standard, which also was uncertain. Finally, Dr. E. Wichers perfected a process of refining platinum until it was chemically pure to within four parts in one million. Comparison of the brilliance of the platinum at the fusing point was then made with the lamp standard and a measurement established that for a time will remain unchangeable. A standard of measurement, Doctor Wensel, director of the experiments, declared, that is predicated on a natural phenomenon is the most precise. No standard of temperature, for example, can be as unvarying as the melting point of ice or the boiling point of water. Nature is far better than instruments, he added. In the case of instruments, one cannot be sure that the materials used in them always will be the same. The new standard parallels those of the above natural phenomena.

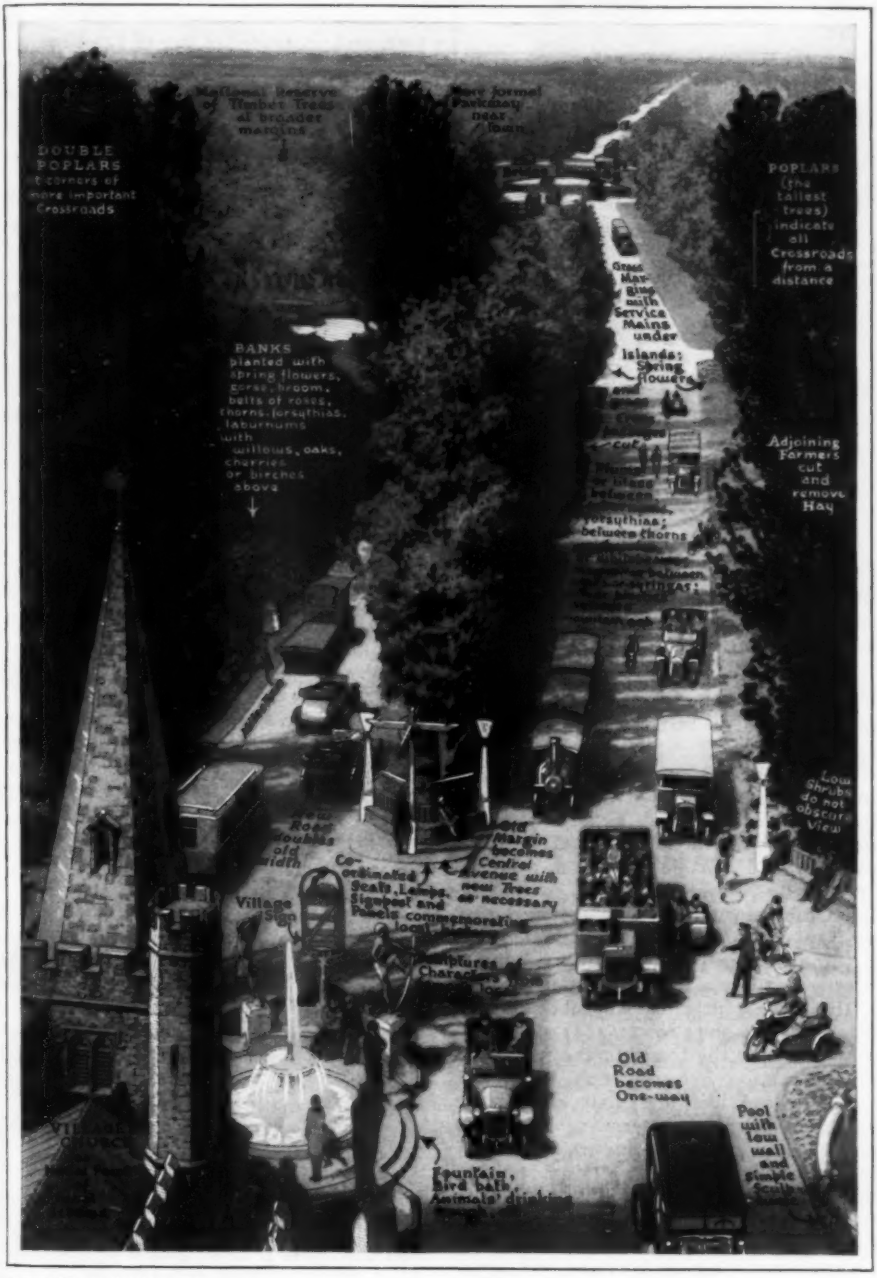
ELECTRIC SHEARS CUT CLOTH AND SHEET METAL



Pair of Shears Operated by Electric Motor for Cutting Many Layers of Cloth at Once

Run by a motor which delivers power through a series of gears to the cutting blades, electrically operated shears save much time and labor in cutting cloth and sheet metal. They cut several layers of heavy cloth in one operation.

HOW MOTOR HIGHWAYS ARE BEING BEAUTIFIED


DOUBLE POPLARS (corners of more important Crossroads
National reserve of timber trees at broader margins
Low formal Pavement near Town
POPLARS (the tallest trees) indicate all Crossroads from a distance
Grass Margin Ring with Service Mains under
Islands: Spring flowers and
BANKS planted with spring flowers, gorse, broom, belts of roses, thorns, forsythias, laburnums with willows, oaks, cherries or birches above
Forsythias between thorns
Adjoining Farmers cut and remove Hay
Low shrubs do not obscure view
Road doubles old width
Grass Margin becomes Central Reserve with trees as necessary
Co-ordinated Seats, Lamps, Signpost and Pedestals commemorating local
Village Sign
Figures Characters
Old Road becomes One-way
Pool with low wall and simple
Fountain, Bird bath, Animals' drinking

Copyright, S. W. Clatworthy

Radio Tower Built in Insulated Sections for Better Reception; Insert, One of the Insulators

SECTIONAL TYPE RADIO TOWER GIVES BETTER RECEPTION

Instead of being one unit of steel supported on large insulators, the 200-foot antenna towers of radio station WHK, at Cleveland, have been broken up into five sections, each about forty feet long, with big porcelain insulators between the sections. This method, which gives more uniform and reliable reception, was developed by Arthur O. Austin, of Barberton, Ohio, internationally known authority on insulation. The ideal aerial is one that is suspended in the air in order to radiate energy in a circle, and the sectional tower is the nearest practical approach to this ideal. In one-piece towers it is often necessary to tune the tower to the frequency of the station because such masses of metal behave like one plate of a large condenser, the other terminal being the ground, and so have a natural period of oscillation. With the sectional towers, the frequency of the individual sections is so high that they do not interfere with station frequency. Ladders and hoisting system for raising or lowering the aerial also are provided with gaps and insulated sections. Electric lights cannot be used because the wires interfere with insulation, and, instead, the top of the tower is lighted with acetylene, the gas being carried in copper tubing with porcelain insulation at each tower section.

DUCKS FLY AS FAST AS PLANE

Ducks can approximate the flying speed of the ordinary passenger airplane, although the faster ships outrun them. The speediest duck is the canvasback which travels at an estimated rate of 145 feet per second, or nearly 100 miles an hour. Mallards and black ducks fly at an estimated speed of seventy-five feet per second or about fifty miles an hour, bluebills from 110 to 140 feet per second, redheads at 120 feet per second and the wild goose at 110 to 125 feet per second.

PRINTING STONE FROM CHINA TWO THOUSAND YEARS OLD

Weighing more than half a ton, a stone slab believed to have been one of the first crude printing machines has been brought to England from China, where it was found. The slab, more than 2,000 years old, has carvings of priests and animals on its surface. It is thought that a form of ink was applied to the face and that copies of the design were rolled off on silk. The stone is recognized as being of the Han period, which was 206 B. C.

© P. & A.

Stone Slab, Found in China, Believed to Have Been Used for Printing 2,000 Years Ago

LINDBERGH'S LATEST PLANE IS BUILT FOR SPEED

Two Views of the Low-Wing Lockheed Vega Monoplane Built for Col. Charles A. Lindbergh; the Two-Place Arrangement with Double Controls Was Designed So That Mrs. Lindbergh May Fly with Her Husband

Built to the order of Col. Charles A. Lindbergh, a Lockheed Vega monoplane that has a top speed of 180 miles an hour and a cruising speed of 150 miles, has been constructed at Burbank, Calif., and has passed successful trial flights. Several distinctive features, not found in the usual Lockheed ship, have been incorporated in this plane. The low wing is a departure from the usual style of ship of this make, there are dual controls, installed so that Mrs. Lindbergh, who already has made solo flights, can fly with her husband and there is fuel-storage space sufficient for 540 gallons of gasoline. It is estimated that the plane will be able to fly, with a full load of fuel, more than 4,000 miles without landing, and will have a normal cruising radius of 3,500 miles. The colonel is said to have suggested several of the ideas incorporated in the unusual streamline design of the plane. Motor cowling, shields over the landing wheels and other features have been employed to decrease wind resistance to an even greater extent than is possible with the ordinary Lockheed plane, which is one of the fastest in the skies. Mrs. Lindbergh is reported to have suggested the color scheme. The plane has a black body and vermilion wings.

¶The pouch of the pelican is used as a scoop or dip net for fishing.

Sea Rovers Battle

Coast Guard Derelict Destroyer "Seneca," Blowing Up Floating Wreckage of Old Vessel by Exploding Mines underneath the Craft; in Shallow Waters, Derelicts Are Usually Towed Ashore and Destroyed

By G. H. DACY

COMB the archives of sea lore and you will find recorded there the amazing wanderings of the "Fannie E. Wilson," the most famous derelict known to American shipping.

For three years, this three-masted schooner, which was wrecked off Cape Hatteras, floated erratically upon the ocean, driven by currents and shifting winds. Seasoned navigators estimate that the abandoned ship cruised 9,000 miles in this crewless voyage.

Uncle Sam's naval rovers who patrol our coastal waters and seek to minimize maritime dangers scouted time and again for the "mystery derelict," as she came to be known. Their quests were futile for they never solved the riddle. Man had no hand in the eventual sinking of that floating peril to shipping. The remains of the "Fannie E. Wilson" were last seen several thousand miles from where her crew abandoned the wreck. Mariners believe that she finally broke to pieces on the rocks.

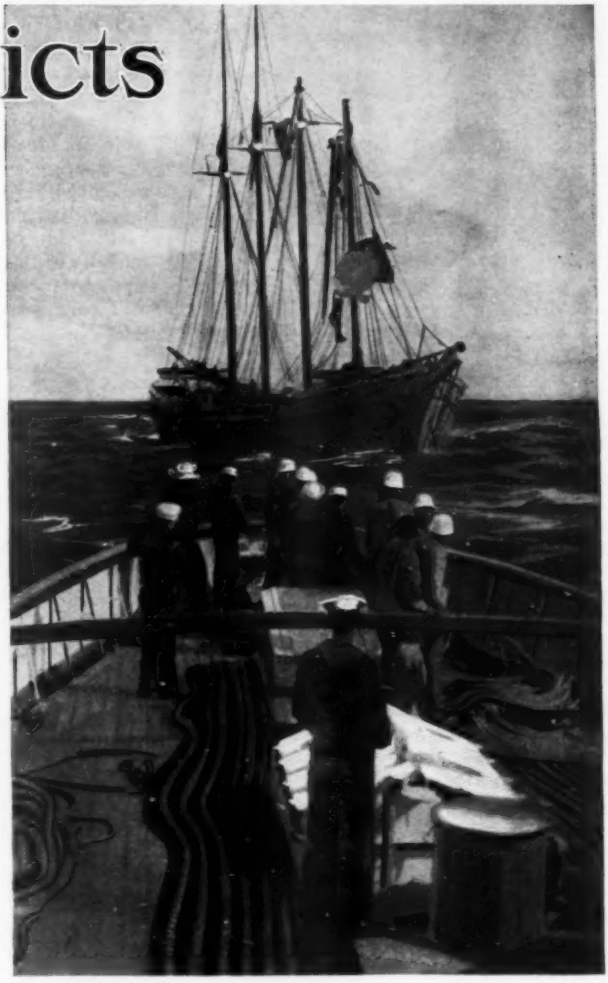
Currents and countercurrents, winds and crosswinds, fair weather and foul, singing gales and smooth seas drove the derelict on one course and another. After abandonment, she swept to sea under Gulf Stream and westerly-wind influences. She cruised to the domain of the latitudes where the northeasterly trades dictated her course. Later, westerly currents and winds brought her back to the Antilles and the region of the Gulf Stream. This cruise was repeated many times, wind and weather driving the derelict over a huge elliptical course.

The "Fred B. Taylor" was another his-

Derelicts

toric derelict, wrecked 400 miles east of New York harbor and subsequently reported forty-seven times, yet always eluding all attempts of the U. S. navy to find and sink that dangerous rover. In the course of time, the stem of this wreck, severed from the hull, was beached in a storm. The bow continued to imperil shipping and finally docked in the unknown harbor of missing ships and wreckage whence return is impossible.

The annals of the U. S. coast guard—its cutters have been engaged in derelict destruction since 1910—tell the strange story of the tank steamer "Oklahoma," a ship that defied the natural order of things by continuing to float for many days though water ran freely into her hull. After being rammed in a collision, the forward end of this ship, about 200 feet long, rode out a severe storm floating bottom up. The coast guards, when they finally found this stray hulk of iron and steel, discovered that the cause of the marine marvel was special air tanks which had buoyed up the wandering wreck. Attempt was made to destroy the derelict by mines placed six feet under the water against her sides. These mines were ineffective. It was not until the wreck was raked below the waterline by fifteen shells fired from six-pounders, that the hulk began to sink and disappeared in seventy minutes.



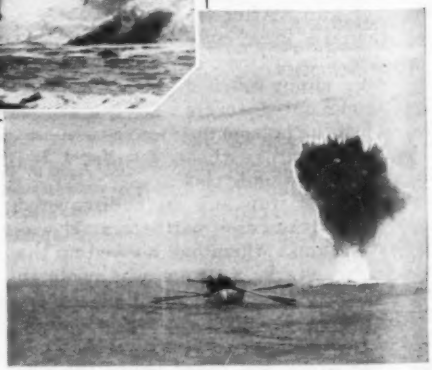
Four-Masted Schooner, Storm-Tossed and Partially Wrecked, Being Salvaged by Coast Guard Crew Before It Becomes a Derelict

Another metal ship which refused to sink for two weeks after being wrecked was the Russian bark "Dorothea." This waterlogged derelict, with headbooms, masts, deckhouses, hatches and bulwarks washed away, continued to ride tempestuous waves. The doomed hulk floated with one side of the deck awash and the other side three feet above the sea. The wreck was reported as occurring about halfway between New York and Bermuda. A

coast guard cutter spent ten days of scouting before it succeeded in locating the derelict one moonlight night when the visibility range was one and one-half miles. The "Dorothea," challenging the law of gravity, had been buoyed up by her cargo of yellow-pine lumber. Uncle Sam salvaged the wreck and cargo.

The British steamer "Erne" of steel construction also floated for days after a collision because of the buoyancy produced by her lumber cargo.

Derelicts discovered along steamship lanes and other marine routes run the gamut of most everything that will float, from whales to sails, spars and masts, from fragile hydroplanes to huge ships, docks, trees, logs and lumber. Three-fourths of the derelicts which jeopardize ocean travel are caused by storms. During the last twelve months, the U. S. coast guard destroyed 267 of these floating hazards of navigation as well as saving $49,000,000 in ships and the lives of 4,375 sailors, officers and passengers. This job of searching for derelicts is often as difficult as ferreting out the mysteries of complicated crimes. Many hours or days usually elapse between the receipt of the radio report and the arrival of the "derelict destroyer" at the point where the floating wreck was last seen. The experienced hunters, familiar with the directions of currents, winds and tempest trends in that latitude, follow four systems of cruising after derelicts. The scout may be made by the zigzag system where the ship sails courses sixty degrees apart with the vessel advancing somewhat and also beating to windward. Spiral scouting consists in the uniform and progressive circling of the suspected region, while in a triangular quest after a derelict, the pursuing ship steams over three courses sixty degrees apart in an ever-increasing triangular cruise. In rectangular hunting, the coast guard cutter cruises over four courses which con-



At the Top, Recovering Floating Masts; in Center, a Derelict in the Making, and, at the Bottom, Removing an Obstruction with T.N.T. Mine

If Mines Fail, Guns Are Sometimes Employed to Destroy the Derelicts; Expert Marksmen of the Coast Guard Show Their Skill in Hitting Difficult Targets

stitute a constantly increasing rectangle, and in all cases makes right-angle turns. This system of searching is used principally in offshore scouting.

You can well appreciate that the hunt may be as difficult as looking for the traditional needle in the haystack by the fact that the abandoned schooner, the "Frederick Roessner"—lumber-loaded—floated 285 miles from the scene of wreck in less than four days. The rate of drift of the derelict depends on the wind, sea, currents and whether or not the wreck is waterlogged. A waterlogged wreck without sails tends to lie in the trough of the sea and drift to leeward about one-half as fast as will a coast guard cutter with her engines stopped. One of these government ships will drift one-fourth of a mile an hour in a light breeze, one mile in a moderate breeze and two miles in a moderate gale.

Cape Hatteras, the Nantucket shoals and the Cape Cod region are the "graveyards of the Atlantic," where stately ships are transformed by storms, currents and shoals into wrecks that drift as derelicts until destroyed. The notable "graveyard of the Pacific" is that tribute-taking stretch of water between Vancouver island, Cape Flattery and Puget sound. As many as three or four large vessels have gone on the rocks there in a single night. A curious fluctuating current on the coastal route between San Francisco and Seattle proves the undoing of foreign ships whose captains are unacquainted with the vagaries of those waters. During stormy, foggy weather, all these hatcheries of derelicts are fertile of potential menaces to other shipping.

"Mining" a wreck is not as simple as telling the tale about it. For example, one four-masted schooner, sunk in twenty-two feet of water, required the explosion of thirty-eight mines, costing about $60 a piece, before the derelict was destroyed.

During clear weather, a derelict ship or other large wreckage is visible at sea for from seven to ten miles. Small flotsam, such as rafts, trees, spars, logs, balks, and the like, are visible for from one to two miles under favorable conditions. On rare occasions, when the sea is like a mirror, the normal range of visibility is increased measurably.

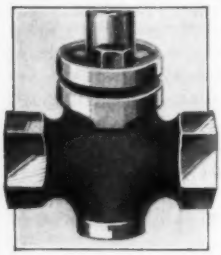
Radio-Controlled Torpedo as It Is Fired from Ship; It Has a Firing Range of Six Miles

TORPEDO CONTROLLED BY RADIO AFTER STRIKING WATER

Controlled by radio after striking the water, the Hammond torpedo recently was tested by the navy, off Newport, R. I. The radio death missile costs $12,000. Except for the fact that its course can be controlled by radio, it looks and fires like the torpedoes that have long been in use. The Hammond type has an effective range of about six miles.

ALARM WHEN PIPE FLOW FAILS PROTECTS MACHINERY

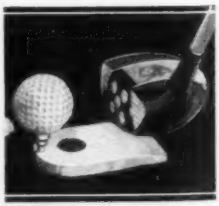
Sounding or flashing a warning when the flow of liquid or gas through a pipe stops for any reason is the purpose of an attachment that may be connected to any piping system to protect machinery from damage. The alarm may be attached to an oil-circulation system, to water circulation for condensers or water jackets, to the fuel supply of an internal-combustion engine, or to a steam, gas or ventilating system. The alarm takes the form of a bell or colored light, and may also be made to stop the engine.



STEEL FLOORS IN SKYSCRAPERS PERMIT TALLER BUILDINGS

Electrically welded steel flooring, which materially reduces the weight of a building while adding to its strength, recently was tested and hailed by architects as a means of erecting taller skyscrapers than have heretofore been possible. Known as the battledeck type of flooring, the material, consisting of steel plates and structural-steel beams, is "stitched" together with an automatic welding machine developed by the General Electric company. The flooring, when in place, resembles a solid steel deck which acts as a girder to prevent any distortion of the building if subjected to wind or earthquake action. The method may also be carried into the walls to provide standard construction to support the outside walls. Cost of the flooring, overlaid with cork tile, thus eliminating the necessity for any other covering, is estimated at less than the cost of the ordinary floor if covered with carpet. Its use is expected to permit an increase of twenty-five per cent in the height of the building or the number of floors of a structure without increasing the load on the foundations.

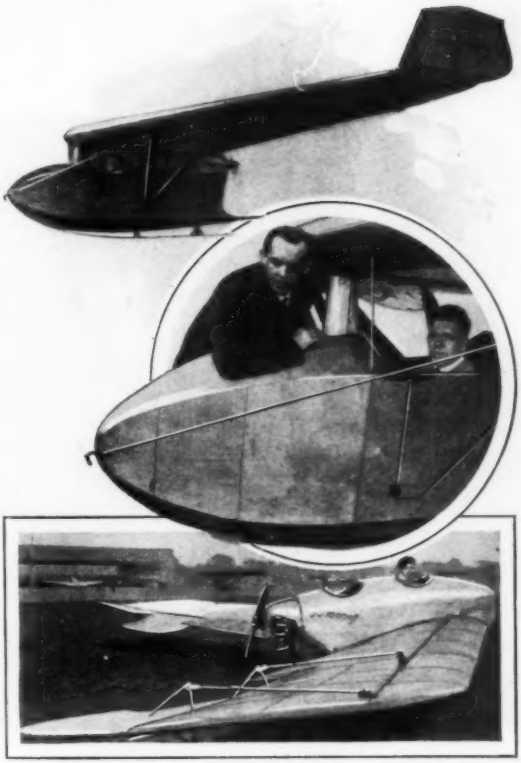
TEE SUPPORT PROVIDES TARGET TO PREVENT TOPPING



Golfers who are troubled with topping, hooking or slicing their ball now may be aided in correcting the faults by a tee which at the same time is a target. The base of the tee is of rubber and on top of the base, just behind the tee, is a red disk which is the target at which the player aims. Using the base also protects sod and clubs. A circular opening in front of the tee allows the wooden peg to emerge when struck by the driver. Swinging the disk to either side of the tee helps to offset the tendency to hook or slice, while topping is corrected by aiming at the disk just behind the ball. This golf accessory also is found helpful in indoor practice.

ELECTRIC EYE MEASURES HAZE IN HOLLAND TUNNEL

Measuring the smoke and haze in the Holland tunnel under the Hudson river is the latest job for the photoelectric cell which has made television and talking pictures practicable. Above the main tube of the tunnel is an exhaust duct through which the gases formed in the tunnel are drawn. It is dark except for light admitted through air openings, and it is here that the photoelectric appliance to measure visibility is installed. A box contains a lamp and photoelectric cell in adjacent light-tight compartments, except for a lens at the front of each. The lens in front of the light makes a narrow beam shining on a mirror, 150 feet distant, from which it is reflected to a second mirror and back to the box where the other lens focuses the light on the cell. The current from the cell is amplified by vacuum tubes, and passes over wires to the recording apparatus in the tunnel office half a mile away. Here it controls the movement of a pencil over a moving strip of paper. When smoke increases, the intensity of the light decreases. The pencil indicates the fact, and, to remedy it, ventilating engineers turn on more fans.



Views of the Motorized Tailless Gliders Tested in Germany; the Engine Is Seen behind Rear Cockpit in Lower Photograph

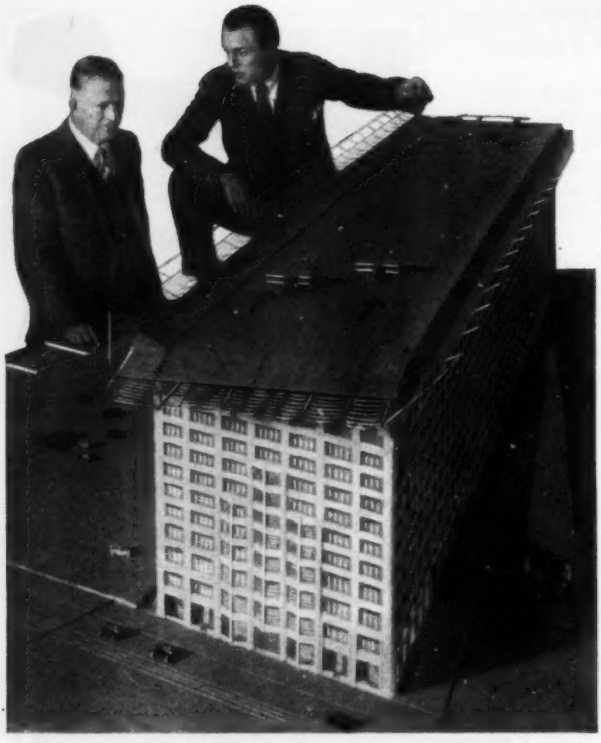
GLIDERS FITTED WITH MOTORS TEST "TAILLESS" FLIGHT

Eight-horsepower motors have been installed in two gliders in Germany and the craft flown to test certain advantages claimed for tailless airplanes. One was flown at a slow rate of speed and was landed at an angle much steeper than would have been possible with the usual plane, aviators declared. Steering is accomplished by rudders at the ends of the wing, and flaps at the rear edge serve as ailerons.

PUPPET SHOW FOR THE HOME IS EASILY ERECTED

Miniature theater stages and settings for the home, school or studio are available in lithographed sheets to be mounted on cardboard and cut out. Based on the modern built-up principle, a great number of settings are obtainable.

Front View of the Miniature Stage Designed for School Instruction or Home Amusement



Model of Industrial Building, Planned for Los Angeles, with Landing Field for Airplanes on Its Long Roof

LANDING FIELD ON LONG ROOF TO SERVE BIG BUILDING

Anticipating the day when it will be practical to land aircraft on the top of buildings, the roof of a huge terminal structure, planned for Los Angeles, is to be fitted for the accommodation of airplanes and other ships. It will be 980 feet long and 152 feet wide.

CAMERA SNAPS ELECTRIC SPARK IN BILLIONTH OF SECOND

By using a spectroscopic camera with a shutter operating in about one-billionth of a second, pictures have been taken of the action of light at various periods during the jump of an electric spark which lasts about one-hundred-thousandth second. Photographic evidence has shown that the magnetic field developed by the passage of an electric current across the spark gap gives a different appearance to the first light emitted, as compared with the light a few millionths of a second later. These pictures of light in flight show that, at the moment the spark jumps, electricity is released in enormous quantities, much as water is released when a dam breaks, and it is this release of energy that causes the temporary magnetic field and the difference in the appearance of the light. In a general way, the spark may be said to snap its own picture, for there is no shutter in the ordinary mechanical sense. The spectroscope camera is set up at one end of a long corridor. When the electric current jumps the spark gap, it sets up a momentary current in a set of wires connected with the camera. This current travels toward the camera at a speed of about 186,000 miles a second and an infinitesimal part of a second later the light from the spark starts toward the camera at the same speed. It is a race between the spark current and the spark light, but by lengthening the wires between the spark gap and the camera, the light is allowed to arrive first, the current reaching the camera to close the shutter a fraction of a second later. By adjusting the wiring, the shutter can be made to close during any one-billionth of a second interval in the first four ten-millionths of a second of the spark's short life. The camera "shutter" consists of two Nicol prisms of Iceland spar, so arranged that under ordinary conditions the light coming from the spark is stopped by polarization and prevented from reaching the camera. Between the prisms, however, is a solution of chemicals which will depolarize the light and allow it to continue,

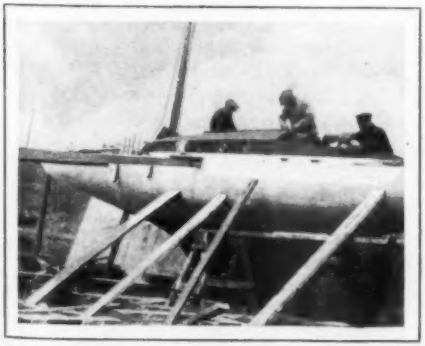
the wires from the spark gap connecting with this solution, so that the current electrifies the solution for one-billionth of a second, thus removing the depolarizing effect and stopping the light passage, or, in other words, closing the shutter.

ELECTRICITY REVIVES INFANTS BY INDUCING BREATHING

Persons apparently dead from electric shock and seemingly still-born babies have been revived by an electrical method tested at the physiological laboratory of Bonn university in Germany. Dr. Fritz Israel, originator of the method, successfully treated six new-born infants by applying electrodes to both sides of either the neck or chest and passing a weak current through the body. By the first application a nerve leading to the diaphragm is excited, and by the second the diaphragm muscle itself is acted upon, forcing expansion of the lungs, or, in other words, artificial breathing. Doctor Zangger, professor of medical jurisprudence at Zurich, Switzerland, similarly revived a man apparently dead of electric shock.

SAILBOAT MADE OF CONCRETE WITH A KEEL OF IRON

Divided into four water-tight compartments, a sailing boat made of concrete has been constructed at the direction of a Stockholm sailing enthusiast. The concrete boat has a sail area of more than 360 square feet. The outside is unpainted and the keel is of iron.



Sailboat of Concrete and Iron Which Is Divided into Four Water-Tight Compartments

Padded Mask Which Protects Boxer's Face but Still Has Openings for Eyes, Ears and Nose

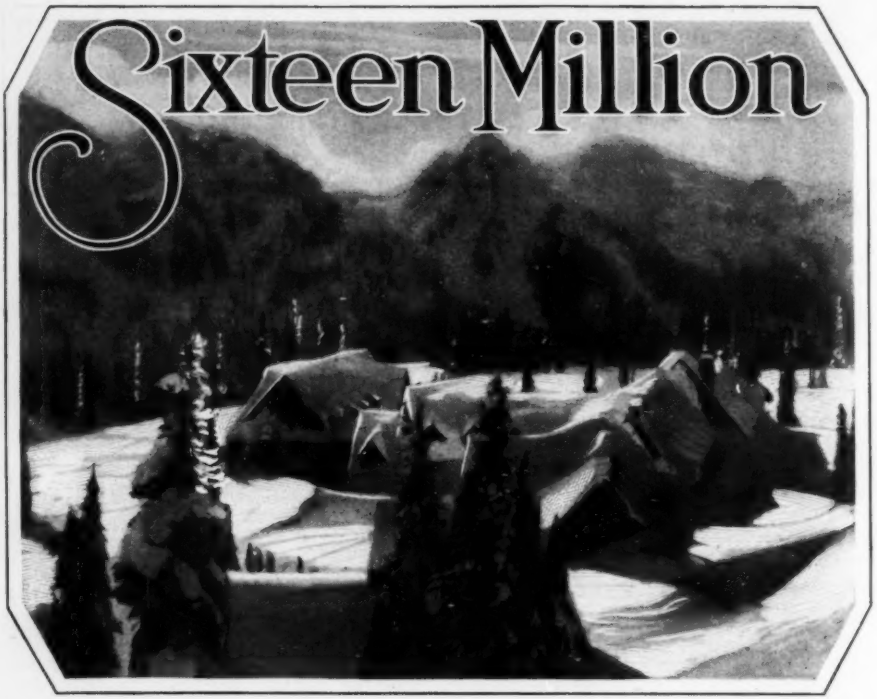
PADDED MASK PROTECTS FACE OF PRIZE FIGHTER

Covering almost the entire face of the boxer, a padded mask has been made to protect the features of the man who likes to box but does not want to be disfigured. Openings for ears, eyes and nose are provided, but even these are protected by the thickness of the mask so that the landing of a damaging blow is impossible.

WATERMELON SEED IS REMEDY FOR HIGH BLOOD PRESSURE

Following a series of experiments, physicians recently announced that an extract obtained from watermelon seeds has been found to offer dependable relief for many cases of high blood pressure. The extract has been named cucurbocitrin and in the tests reduced the pressure of blood coming from the heart by more than ten millimeters in seventy-three per cent of the cases. Use of the extract afforded relief to eighty-two per cent of the cases in experiments with thirty-nine patients. The drug in most cases appeared to offer immediate relief, but better results were obtained with cases of short duration and with patients under fifty years of age. No untoward aftereffects were observed, but the tests indicated that the treatment should be used only in certain selected cases, and not as a general remedy.

Sixteen Million



Paradise Inn, Mount Rainier, in Mid-Winter with Snow Lying Twenty-Two Feet Deep on the Level; the Snowfall in This Region Is Seldom Surpassed Anywhere in North America

By CALVIN FRAZER

THERE are two things in the economy of nature of which few people have any adequate conception. One is the amount of water that falls upon the earth in the form of rain and snow. The other is the amount that passes off into the air by evaporation.

The two amounts are, in the long run, exactly equal. For every ton of water that falls upon the globe a ton is returned, in gaseous form, to the atmosphere, though not, as a rule, at the same place where it fell. The oceans, lakes and rivers generally lose a good deal more water by evaporation than they receive directly from rainfall. The lands, for the most part, lose less, though a tract of land covered with luxuriant vegetation, especially with forests, vies with a corresponding area of water in the amount of moisture it supplies to the air.

How much water is involved in these processes? The records of precipitation and evaporation for different parts of the world, as given in reference books, do not sound impressive. The reason is that both these things are measured and recorded in terms of depth rather than volume or weight. The unit used for such data in English-speaking countries is the inch, which seems an insignificant quantity until you learn that an inch of rainfall means 113 tons of water to the acre, or 72,320 tons to the square mile.

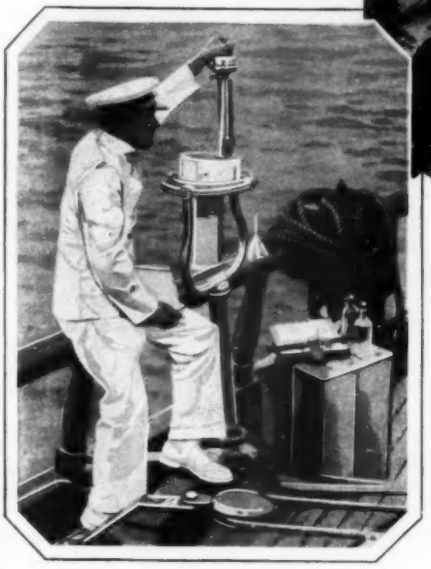
The amount of water that falls in a single widespread shower is often enormous. In the county of Norfolk, England, one day's rain brought down 670,720,000 tons of water—more than twice the amount contained in England's largest lake, Windermere. Much more remarkable downpours have occurred in tropical and subtropical countries. A few years ago rain fell over an area of about 10,000 square miles in India. The readings of numerous rain gauges within

Tons a Second

this area made it possible to determine with reasonable accuracy the total fall of water in the shower, which was found to be something like 7,000,000,000 tons!

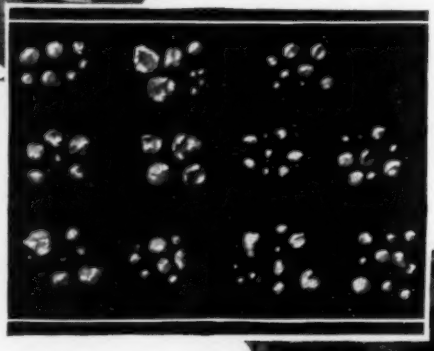
Even with this figure in mind, the reader may be startled to learn that the amount of rain and snow falling on the entire surface of the earth averages about 16,000,000 tons a second.

Day after day, year after year and century after century, this prodigious deluge goes on, yet the oceans get no fuller, the land, as a whole, gets no damper, and the atmosphere, despite this tremendous drainage of its moisture, gets no drier. The reason for this paradoxical fact has already been stated—rainfall is exactly counterbalanced by evaporation.



Courtesy Carnegie Institution
Top, Salt and Oil Gauge in Measuring Snow in Alps; Below, Evaporation Gauge on Shipboard

Though the exchange of water between earth and air is unceasing, it is accomplished in an exceedingly irregular way. Moisture borne by the winds forms a constantly changing pattern of cloud distribution over the globe. The clouds affect moisture conditions on the earth beneath them by checking evaporation, even when they do not yield rain. When rain occurs, it is more or less uneven in its fall and often strikingly so, ranging from a cloudburst in one spot to a mere sprinkle in another. All these irregularities are reflected in the distribution of water in the soil, the flow of streams, the yield of springs and the depth of water in lakes and reservoirs.



They are also reflected to an almost incalculable extent in the practical affairs of mankind. An overabundance of rain in the basin of the Mississippi in the spring of 1927 caused floods that cost the American people over $350,000,000, besides entailing considerable loss of life. The recent frightful famine in China illustrates the calamitous effects of drouth. Though in most parts of the world drouth no longer takes toll of human life, its economic effects are often of immense importance. Drouths were exceptionally prevalent during the year 1929. The grain-growing districts of Argentina had one that lasted six months, and when it broke, in September, the price of wheat dropped four cents a bushel on the Chicago market.

Rainfall is the most variable and uncertain element of weather. Whoever examines for the first time a chart showing the normal distribution of this element over almost any large country cannot fail to be struck by the contrasts in the amounts indicated for different districts. In the United States, for example, the range is from a little over an inch and and a half a year in Death Valley, California, to more than 130 inches a year in Tillamook county, Oregon. These geographical contrasts are only half the story of rainfall diversity. The other half is furnished by the variations that occur from time to time in any one locality. It is a remarkable and little known fact that almost the only parts of the world where people have no reason to worry about occasional drouths are the desert regions where drouth is a permanent condition.

A good illustration of the rainfall vicissitudes that the American farmer has to reckon with was recently reported. The village of Dresden, in northwestern Tennessee, lies in a region where the average rainfall in June is about three and a half inches and that of July about three and three-fourths inches. In 1928, the weather bureau station at that place registered 18.67 inches of rain in

Measuring Stream Flow with Current Meter; Casts of Rain Drops, and Making a Snow Survey

A Result of Too Much Rain; an Air View along the Mississippi during the Flood of 1927, One of the Greatest in American History; Note Break in Levee at Top of Picture

June. During the whole of July only "traces" of rain fell; in other words, no day's rainfall was large enough to be measured.

The driest regions of the earth sometimes experience torrential downpours. At Yuma, Ariz., in 1921, there was a rainfall of 3.65 inches in twenty-four hours—more than the normal amount for the entire year at that place. The so-called "rainless" coast of Peru, where years go by without a shower, has had at rare intervals rains heavy enough to cause destructive floods.

Because of these endless variations of rainfall and their well-recognized importance to humanity, the measurement of rain has always been the biggest job of the meteorologists. So far as we know, it was first undertaken in India some centuries before the Christian era. Ancient Sanskrit texts give figures for the rainfall of different parts of that country, indicating the existence of rain gauges and their systematic use. Measurements of rainfall were made in Palestine in the first century after Christ.

At the present time, rain is measured once a day or oftener at upward of 35,000 places throughout the world. The distribution of these places is, however, extremely uneven. The densest "network" of rainfall stations in the world is found in the island of Barbados, which, with an area of 166 square miles, has about 200 such stations. There are approximately 5,000 rainfall stations in the British isles—about the same number as in the immensely larger area of the United States. As compared with Britain's average of one rain gauge per nineteen square miles, we have in this country an average of one for each 595 square miles. Of course there are many countries in which rain gauges are far scarcer than in the United States. Though numerous measurements of rainfall have been made on shipboard, the statistics for the oceans are little better than rough estimates.

For certain practical purposes it is important to know not only how much rain falls from day to day, but also how fast it falls in individual showers. Records of excessive rates of rainfall are especially valuable to engineers in planning sewers, which must be made large enough to carry

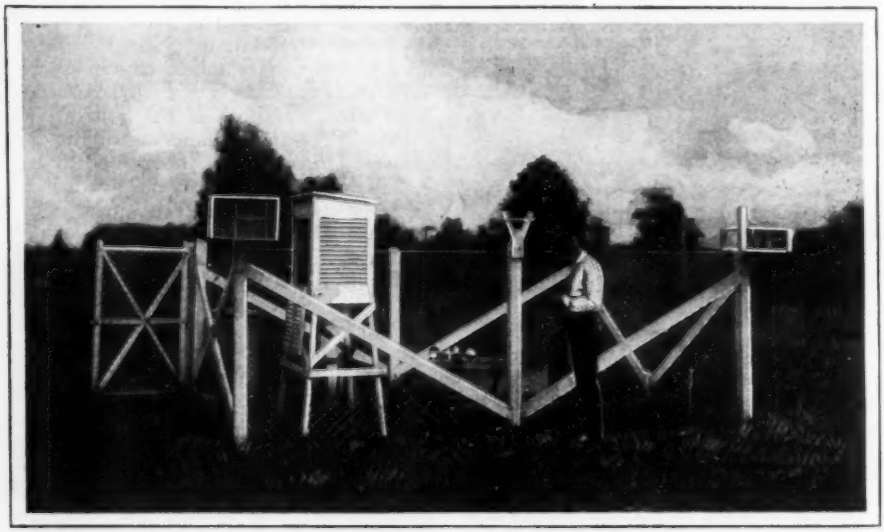
off the "storm water" from the heaviest showers likely to occur in the locality; also in connection with the design of hydroelectric plants, irrigation systems, and the like. Such records can be obtained only from self-registering gauges. These instruments are costly, and the total number of them in the world is small compared with the number of ordinary rain gauges.

The fastest shower ever recorded with one of these automatic gauges occurred on April 5, 1926, at Opid's Camp, a mountain station in California maintained for the benefit of the Los Angeles county flood-control commission. By a lucky chance, two self-registering gauges of the "weighing" type had been set up side by side at this place, in order to compare their readings, when the shower occurred, and both showed a fall of 1.02 inches in one minute. The previous world record was 2.47 inches in three minutes at Porto Bello, Panama, Nov. 29, 1911.

Rain gauges are made in a great variety of forms, though certain principles are common to nearly all of them. An almost universal feature is a conical receiver with a small orifice intended to reduce evaporation. In the common American gauge, the rain falling into the receiver flows into an inner tube of small diameter, so that the depth of water is magnified ten times. This is for the purpose of facilitating measurement, which is made by means of a stick graduated so that a depth of one inch in the tube reads one-tenth of an inch on the stick. In European gauges the same result is accomplished by pouring the water from the gauge into a measuring glass of much smaller diameter than the gauge, so that the depth of water is similarly magnified.

The automatic rain gauge most used by the weather bureau—known as the "tipping-bucket" gauge—is a remarkable combination of simplicity and ingenuity. The rain flows into a little metal trough divided by a central partition into two compartments and mounted on a central pivot. The alternate filling of the compartments causes the trough to tip back and forth. Each tip represents one-tenth inch of rainfall and is recorded by a pen on a moving sheet of paper, ruled to show the time of occurrence. This gauge has a distinguished ancestry. The first one operating on the same principle was constructed by the famous English architect, Sir Christopher Wren, about 1662.

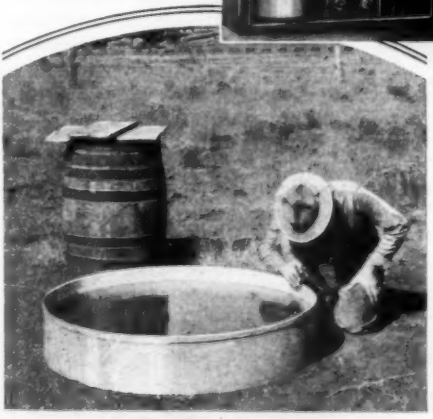
In so-called weighing rain gauges, the water collects in a vessel resting on a



Evaporation Station of the United States Weather Bureau; the Pan Is Seen in the Middle of the Inclosure with the Wind, Rain and Other Gauges

coiled spring. As the water accumulates the vessel descends and its movement is registered by a pen. In still other types of automatic gauge, the recording pen is connected with a float, which rises as the depth of water increases. One of these, invented by Prof. C. F. Marvin, the present chief of the weather bureau, makes a week's record on a single sheet of paper.

In measuring rainfall as an element of climate, meteorologists include snowfall, but the actual depth of the snow must be reduced to its water equivalent before it can be combined with statistics of rain. One way of doing this is to melt the snow caught in the rain gauge before measuring its depth. Another plan is to weigh a sample of snow and compute the corresponding depth of water.

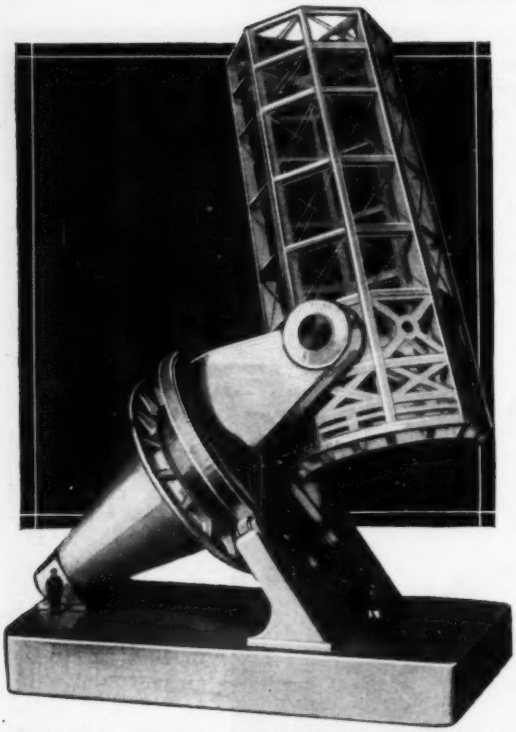


A Tipping-Bucket Rain Gauge; Gauging River at Distance, and Close View of an Evaporation Pan

There are several devices for measuring mountain snowfall at places far from human habitation. Some of these measurements are made in connection with the study of glaciers; others in order to estimate the amount of water the melting of the snows will yield for adjacent power and irrigation projects. Special gauges used for such measurements catch and store a whole season's snowfall, while in some regions the depth of the snowfields is measured from time to time by means of snow stakes set permanently in the ground. The snow sampler is a long steel tube, with a sharp edge, by which cores of snow can be cut through a snowfield. The cores are weighed and the results of many such measurements furnish an indication of the prospective water supply.

Evaporation, like rainfall, is measured in terms of depth. The instruments employed are variously known as atmometers, atmidometers, evaporimeters, evaporating pans, and so on. Many attempts have been made to develop mathematical formulas by means of which the amount of evaporation might be computed, but this problem seems to be beyond solution, and reliable data can be obtained only by actual measurements.

The importance of evaporation in connection with irrigation may be judged from the fact that the total amount of water evaporated from the reservoirs of the U. S. reclamation service in the western United States is estimated at 1,000,000 acre-feet a year—enough water to irrigate an area of about 250,000 acres of land.



Model of World's Largest Reflecting Telescope Which Will Weigh Thirty Tons and Have a 200-Inch Mirror Disk

GIANT EYE TO PROBE SPACE WEIGHS THIRTY TONS

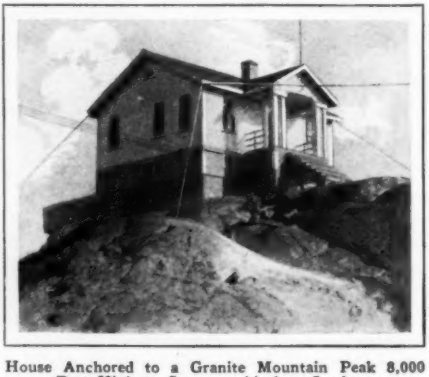
Equivalent in many respects to the human eye, but with a pupil seventeen feet in diameter, the largest reflecting telescope in the world is to be built in southern California or Arizona. It will have a mirror 200 inches in diameter weighing thirty tons, and it is hoped that it will penetrate more than three times as far into space as any existing instrument.

MURALS ARE SAVED FROM MOLD BY POISONING FUNGI

American chemists have succeeded in saving from destruction by mold the only official records of the construction period of the Panama canal, a series of five mural paintings in the administration building at Balboa. Presence of mold became apparent a year ago on the pictures, which cover 400 square feet and are attached to the walls so they could not be removed for laboratory treatment. The murals show features of the actual construction of the canal now hidden by fifty feet of water, and the circular walls of the rotunda which the paintings adorn made construction of a fumigation chamber almost impossible. Chemists finally removed the porous beeswax with which the murals were covered with turpentine and alcohol, then applied a liquid fungicide to kill the deep-seated spores of the mold. The dead fungi were removed by washing with ammonia, and a thin coat of paraffin and some of the fungicide were spread over the surface of the murals for future protection.

PLANE LOOKOUT BUILT ON GRANITE PEAK

At an elevation of 8,000 feet, a cottage has been built on a granite peak of the Sierra Nevada mountains by the United States department of airways which will serve as an airplane lookout. The attendant occupying it takes care of beacon lights, forwards weather reports and keeps watch for planes in distress during bad weather. The cottage has a coal-burning furnace and electric lights from a near-by power line. It is anchored by cables to the solid rock to resist the wind.



House Anchored to a Granite Mountain Peak 8,000 Feet High to Serve as Airplane Lookout

Air Riddles and the Answers

Automatic Pilot Which Keeps a Plane Level in Any Weather; the Flying Robot Takes Control When the Stick Is Dropped, Preventing Dives or Spins and Making the Ship Fool-Proof

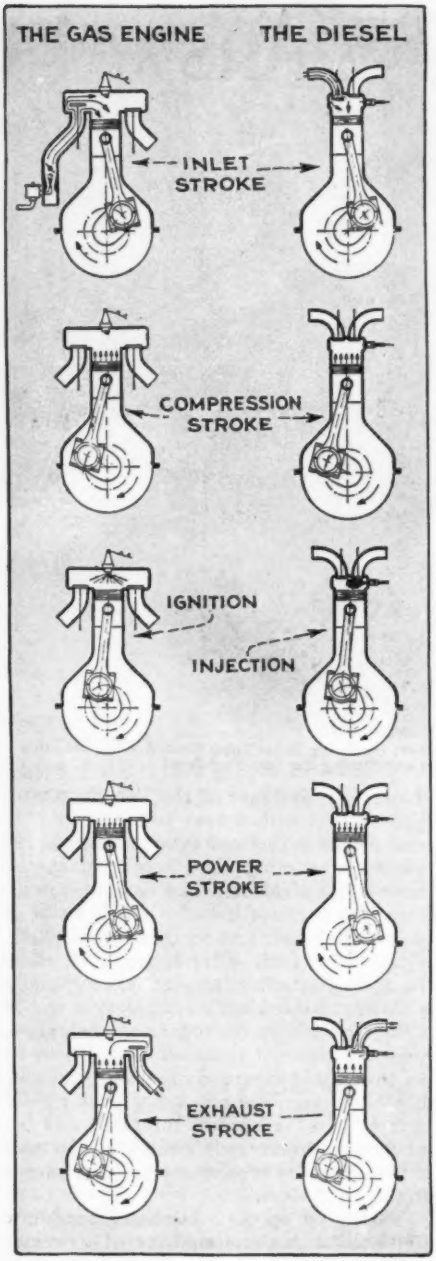
"WHAT," a reader asked the other day, "is the difference between a radial and a rotary airplane engine, and to which class do the Wrights and the Wasps belong?"

The answer is that all the famous aircraft engines today of the air-cooled type, with cylinders arranged in a circle about the crankcase, are radials. And the difference between the radial and the rotary is that the cylinders of the first remain fixed in place, while the cylinders of the latter revolve.

It is doubtful whether there is a single rotary still in service today, for, since the Gnome motor of war-time days, the rotary has been dropped. Their one claim to worth—light weight per horsepower—has been surpassed by the more efficient radial engines.

The idea behind the Gnome was that the revolving cylinders would cool better than if they were stationary. Charles L. Lawrance, designer of the Wright motor, proved that with proper cooling fins a radial motor with fixed cylinders would get plenty of cooling air when fixed to the nose of an airplane. The Gnome was interesting because it had a single valve, a fixed crankshaft and its moving cylinders. Gasoline and air were brought together in a mixing valve, and an exceptionally rich mixture fed, through passages in the cylinder walls, to the tops of the cylinders, where additional fresh air was drawn in to thin the mixture down to the proper combination. The crankshaft was rigidly attached to the nose of the plane and remained stationary, while the propeller was attached to the revolving crankcase carrying the cylinders.

The radial, on the other hand, combines lightness with the simplicity of gasoline, oil and electrical connections which its fixed cylinders make possible, removing all the chief objections of the rotary. The



Drawing Illustrating Difference in Principle Between the Gas Engine and Diesel Engine; Absence of Ignition Is the Chief Characteristic of the Latter

arrangement of the cylinders in a circle makes possible a very short crankshaft with a single throw, eliminating the troubles experienced in the long shafts of conventional engines, built like the motors in automobiles. All the connecting rods are attached about the circumference of a single sleeve, fitting over the throw of the crank. The radial has one big disadvantage: Its broad spread of cylinders increases the frontal area of the plane, and therefore cuts down the speed, due to wind resistance. This is being largely overcome, however, as the result of the development of special cowling which, on a typical installation, increased the speed of a plane seventeen miles an hour, without any other change being made, and still admitted sufficient air to cool the cylinders properly.

"What happens to the engine when the plane does a loop?" another reader asks.

The answer is, nothing. The carburetor goes on functioning just as it did when the plane was right side up, the oil remains in the crankcase where it belongs; in fact, the engine performs as normally upside down at the top of a loop as it does right side up in level flight.

The reason is that centrifugal force maintains the status quo. That this is true is easily demonstrated by placing a glass of water on the floor of the cockpit before doing a loop. The glass will not fall out, nor will the water be spilled, any more than the contents of a bucket will spill when it is whirled over the head. The same force, in both cases, keeps the liquid in place

However, if, instead of coming out of the loop, the pilot elects to fly along in level flight, upside down, things begin to happen at once. The carburetor float drops out of position, the carburetor drains, the engine stops, the oil in the crankcase flows past the pistons and fouls the plugs, and, if the engine is water-cooled, the water drains out of the radiator. For such "stunts," a double carburetor generally is used together with a radial motor which eliminates the oiling trouble.

Another question asked is how fast a propeller can turn before it begins to thrash the air and lose its effectiveness. No one knows a definite answer to that.

Motorboat men discovered long ago that there is a point where what is called "cavitation" sets in, and the water becomes so disturbed that a further increase in revolutions produces no effect. That point, however, differs with each design of propeller, and outboard engines are being run today with propeller speeds that would have seemed fantastic only a year or so ago.

As a general thing, with standard types of propellers, efficiency seems to decrease when an airplane engine is geared up to more than 2,000 revolutions per minute, but a propeller speed of 3,200 revolutions per minute was used with a specially designed prop on the Bristol "Bullet," built by England for the Schneider cup races. Many of the small fast racers are now being built with geared-down propellers, the engines turning over at speeds of 4,200 or more, and a two-to-one reduction gearing being used to cut the propeller speed in half. A big slow-turning propeller is more effective as a load puller than a small high-speed prop, which explains why speeds of 1,400 to 1,600 revolutions per minute are in general use for aircraft engines.

Electrically Heated Flying Suit, Helmet and Boot, Warmed by "Plugging In" on the Dash Control

A Memory Meter for Depth Sounding from Planes; Lights Flash as the Ship Nears the Ground

Another interesting question deals with engine torque, and why the twisting effect of the engine turning over at high speed doesn't cause the plane itself to try to revolve in the same direction, turning on its longitudinal axis. The answer is that the immense spread of wings exerts too much resistance against the air to allow the plane to revolve. As a direct offshoot of its inability to turn, however, the engine imparts a force to the plane which makes it want to go off the course to one side.

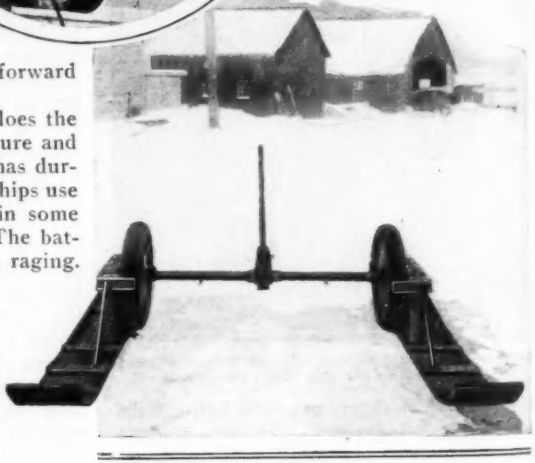
Most modern ships correct that by setting the front edge of the vertical fin a trifle off center, so that the continual blast of air along one side of the fin will be just sufficient to overcome the engine twist and keep the nose on the course. In lieu

At Left, Toy Plane That Will Remain Aloft Three Hours; in Circle, Locking Device Which Counteracts Safety Slot, Making Wing Stalling Possible

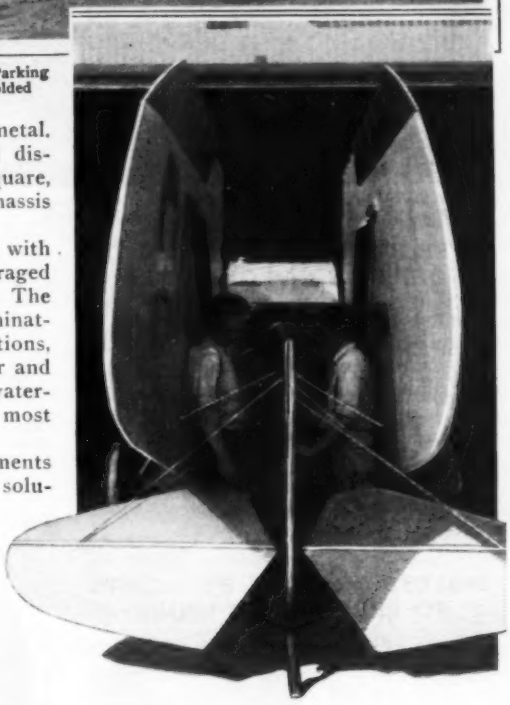
of that setting of the fin, the pilot must always carry a small amount of opposite rudder. If the ship has an engine revolving in the normal direction—to the right as you look forward—the left rudder pedal is pushed forward a trifle.

Why, another questioner asks, does the Fokker use a wooden wing structure and a metal fuselage, while the Ford has duralumin wing and body, and other ships use either all wood or all metal, or in some cases combinations of the two. The battle of metal against wood is still raging. Some designers believe spruce spars and ribs build up a better cantilever structure than can be formed of metal; some insist that hollow tubing is in danger of hidden rusting on the inside. On at least one ship, the Fairchild, all tubes are connected by small holes, and then pumped full of boiling oil to make sure they are air-tight, after which the oil is drawn off and the holes sealed. That insures against corrosion.

Plane design and plane building is still so much in its infancy that every aeronautical engineer has his own ideas of what's best. When the automobile was far older, in point of production if not in years, than the airplane is today, one maker used an air-cooled engine, while all others used water cooling, and the same maker used a wooden chassis



Combination Ski-Wheel Landing Gear for Alighting on Snow after Take-Off from Bare Ground



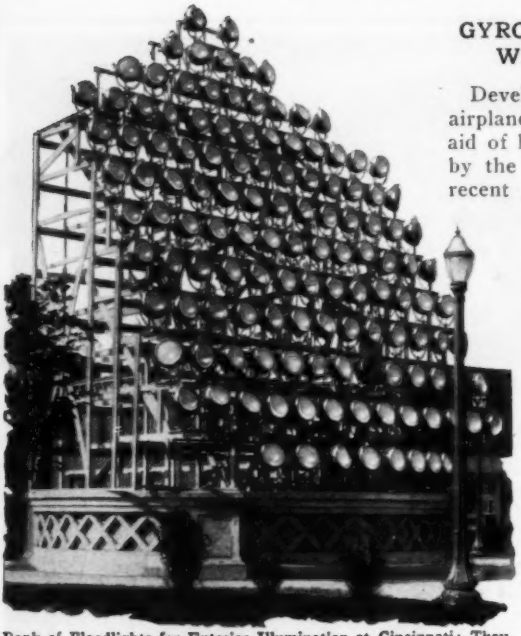
Monoplane Whose Wings Can Be Folded for Parking in a Garage; Below, Rear View with Wings Folded

when everybody else had settled on metal. And automobile engineers are still disagreed on the relative merits of square, round and elliptical tubing for chassis braces.

Even the many successful flights with air-cooled engines have not discouraged the proponents of water cooling. The army is tackling the question of eliminating some of its more obvious objections, which include the weight of radiator and cooling liquid and the fact that a water-cooled engine must operate below its most efficient temperature.

To that end successful experiments have been made with a new cooling solution, a chemical compound whose chief ingredient is the same glycerine offshoot used as an anti-freeze in automobile radiators. The compound has a boiling point more than 100 degrees above that of water, and, instead of operating the engine at a temperature of 180 to 200 degrees, as must be done with water cooling, it can be operated at around 300 degrees, which gives much better performance. Besides its higher boiling point, the new liquid requires less water for cooling, and therefore a smaller radiator, so weight is cut down, and also the frontal area of the radiator is reduced, with consequent reduction in air resistance and increase in speed. The latest chemical-cooled plane introduced for army pursuit work is the Curtiss P-6 "Hawk." It has a high speed of 181 miles an hour, and the chemical solution permits a reduction of 125 pounds in weight.

About 250 kinds of snakes are poisonous.



Bank of Floodlights for Exterior Illumination at Cincinnati; They Are Mounted on a Framework Thirty-Six Feet High

OVER HUNDRED FLOODLIGHTS OPERATED AS ONE UNIT

As a part of the decorative scheme for the Edison exposition held in Cincinnati, Ohio, a total of 127 floodlights for outdoor illumination were installed in one great bank, all the lights operating simultaneously. When all were lighted they drew a total of 82,000 watts, the equivalent of 110 horsepower. The framework for the unit extended into the air thirty-six feet.

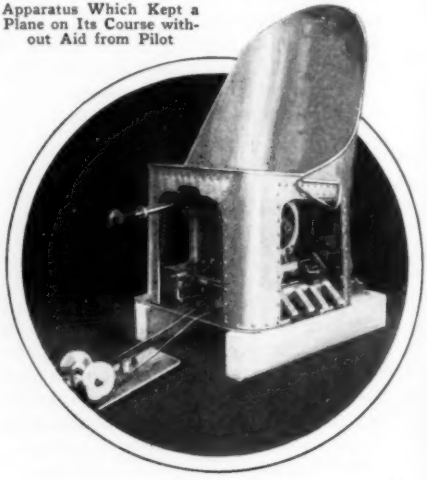
INSECTS TRAPPED BY LIGHTS TO FEED YOUNG TROUT

Liberal supplies of insects to feed young trout are obtained at a California hatchery with the aid of funnel-shaped cloth sacks and electric lights which are left burning all night. The insects, attracted by the glow, become enmeshed in the traps and are collected the next morning. By using a number of sacks, many pounds of flies and other insects were caught. These are supplemented with other foods to give the young trout a varied diet.

GYROSCOPE PILOTS AIRPLANE WITHOUT AID FROM MAN

Development of a gyroscope to keep airplanes on their courses without the aid of human hands has been announced by the war department as the result of recent tests. With this automatic pilot, the human flyer takes the plane off the ground, then turns it over to the robot pilot until the time comes for landing. The mechanical pilot will hold the plane straight and level, regardless of fog, rain or darkness. It is expected to be useful particularly in handling large planes and on long flights, relieving the pilot of much of the strain. The mechanical flyer weighs fifty pounds and occupies a space fourteen by fourteen by ten inches beneath the pilot's seat. Its action centers around two gyroscopes, one mounted vertically, the other horizontally. A series of electrical contacts actuate electromagnets, that in turn operate controls leading to rudder, elevators and ailerons. Power is obtained from a small wind-driven generator. So sensitive is the instrument that movement half a degree out of level flight is detected. The apparatus flew an army plane from Dayton to Detroit without direction from the pilot.

Apparatus Which Kept a Plane on Its Course without Aid from Pilot



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Making a Moving Picture for Transmission by Radio; Actors Are Shown in Silhouette, and Pictures Are Taken in That Manner as This Is the Form in Which They Are Received

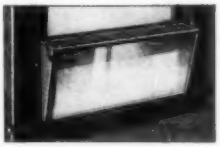
MOVIES TAKEN IN SILHOUETTE FOR RADIO TRANSMISSION

Devoted exclusively to the production of motion pictures to be shown to an audience by radio, a studio has been opened in Washington by Dr. C. Francis Jenkins, inventor and television pioneer. The performers all are shown in silhouette.

NEW USES FOR PEANUTS FOUND IN MANY BY-PRODUCTS

Utilization of the peanut for many purposes besides food has stimulated their cultivation, particularly in Oklahoma, where 82,000 acres were planted to them last year, an increase of 1,200 per cent in the last five years. Chemists have discovered that almost every part of the peanut, the top, hulls, nuts, skins and germs, has value. When properly cured, the tops make nutritious hay, comparable with alfalfa, they say. Three tons of hulls are equal to a ton of coal in fuel value, and the hulls are also employed to absorb the palm oil on galvanized iron in its manufacture. Large quantities are used as filler in fertilizers, and in the manufacture of cellulose for fiberboard. They also contain a kind of sugar. The skin and germs, removed from the nuts, contain twenty to thirty per cent of oil which is sold for stock feed or for soap. A nutritious flour is manufactured from the peanut. It is said to contain four times as much protein, eight times as much fat and nine times as much mineral substance as white flour. One ton of nuts gives about 600 pounds of oil.

WINDOW VENTILATOR SCREEN KEEPS OUT DUST



To keep dust from the interior of the room, a window ventilator now on the market is fitted with a screen of fine mesh. It is shaped to lie closely against the sash and may be removed in a second or two for cleaning.

Three Views of an Airplane with Detachable Pontoons beside the Landing Gear to Transform It into a Seaplane

PONTOONS TURN SMALL PLANE INTO A WATER CRAFT

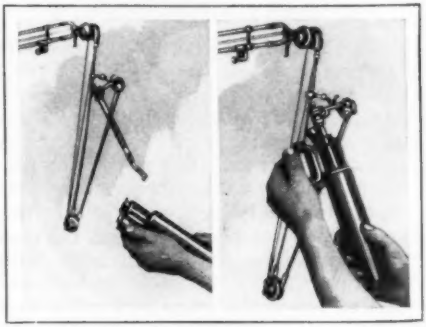
Transforming a small airplane into a seaplane within a few minutes may be accomplished by installing pontoons beside the wheels. Equipped for water flying, the craft weighs only 340 pounds, making it one of the smallest planes to take off on land or water. The lightness makes it possible to rise from or alight on a comparatively small area, the craft having an exceptionally low take-off and landing speed. The pontoons weigh thirty pounds each, are nine and one-half feet long, a foot deep and sixteen inches wide, and are placed a little more than four feet apart. Maneuverability of the craft apparently was not affected by installing the pontoons, as it went through any stunt that was possible when equipped with landing gear. The little ship, with pontoons attached, in tests took off from the water in eight seconds in still air, and climbed 450 feet the first minute.

SHELLAC FROM OLD DERBIES

Discarded derby hats and silk toppers are gathered in carload lots by a Fall River, Mass., merchant who puts them through a salvaging process to recover the shellac that provides the stiffness and constitutes one-third of the weight of such headgear. After the shellac is dissolved in a soda solution in which the hats are soaked, the remainder is baled and shipped to a fertilizer factory.

STERILIZER FOR DENTISTS' GRIP HELPS CURB DISEASE

Easily attached to the wall or to the dentist's handpiece, a small sterilizer, charged with formalin gas, keeps the cap, angles and handpiece sanitary without injury to the instruments. These units, coming in contact with a patient's mouth, may be the means of spreading various diseases unless kept clean, and the gas chamber is offered as a simple and effective way to afford such sanitation.



Sterilizer Attached to Dentist's Handpiece to Keep Instrument Free of Disease Germs

DUST—what It Does

THE ENORMOUS amount of solid material contained at all times in the air is one of the startling revelations of modern science. Some measurements and analyses of atmospheric pollution have just been made in New York City. Though the air of Gotham is undoubtedly cleaner than that of many of the large manufacturing centers of the country, these studies show that, at any given moment, the solid matter suspended in the air of the city up to a height of 200 feet above the ground weighs, under average weather conditions, 2,200 tons.

Making a Dust Count in Airplane over Washington, D. C., and Measuring Dust by "Paper Thimble"

The composition of this dust is as interesting as its quantity. About sixty-five per cent is carbon, fifteen per cent mineral and ash, and twenty per cent organic material, including an immense variety of germs, pathogenic and otherwise. The large amount of carbon furnishes a striking example of industrial waste. It consists of unconsumed coal, gasoline, motor oils and other fuels. If this carbon could be collected and burned, it would suffice to operate the city's electric-light and power plants for six hours out of every twenty-four.

Even more remarkable figures bearing upon the dust content of the atmosphere are supplied by the records of "sootfall," and by the statistics of occasional showers of dust that have occurred over great areas of the earth's surface. The sootfall records usually represent the total deposit of solid impurities in districts where the chief cause of atmospheric pollution is the imperfect combustion of fuel. In Pittsburgh, before the smoke nuisance was partially abated, the annual sootfall averaged 1,031 tons per square mile. In Great Britain, where the atmosphere is notoriously smoky, sootfall is measured regularly with gauges of uniform pattern at about sixty places under the direction of the advisory committee on atmospheric pollution. In the heart of Glasgow, 820 tons of soot and dust per square mile is collected in an average year. London's

average is 248 tons per square mile.

Individual showers of dust, known as "dustfalls," entail the temporary suspension of enormous quantities of dust in the air. One of these showers occurred in March, 1901. The dust was whirled aloft by cyclonic winds from the floor of the Sahara desert and was eventually deposited over most of western Europe to a distance of 2,500 miles from its place of origin. The fall on the European continent in four days was estimated at 1,800,000 tons. Much more fell over the Mediterranean, while on the African coast the deposit is supposed to have amounted to 150,000,000 tons. Europe has experienced many gigantic dustfalls coming from the Sahara, but in the latest great shower, that of April, 1928, the source of the dust was different. It was blown up from the dry soil of southern Russia north of the Black Sea and fell as far west as the Baltic. In Poland alone the deposit was estimated at 1,500,000 tons.

The transportation of dust by the winds is an agency in shaping the surface of the earth comparable in importance to the transportation of soil by water. Thus in China vast areas are covered to a depth of hundreds or even thousands of feet with a fine yellowish material called "loess," which is believed to have been blown there by winds from the deserts of central Asia. Less extensive deposits of this wind-borne material are found in other parts of the world, including the Mississippi valley. Another effect of winds is the mixing of soils. There is a constant interchange of soil material between different regions, so that the composition of the soil on a particular farm, for instance, is not the same now as it was a few years ago or as it will be a few years hence.

The greatest concentration of dust in the air ever occurring under natural conditions is probably that found in the midst of a desert dust storm, or sand storm, where, according to an estimate of Prof. J. A. Udden, it may reach 126,000 tons of suspended solid matter per cubic mile of air. Such storms are common

Direct-Vision Dust Counter; Dust Particles Magnified 100 Diameters, and Measuring Dustiness in Stone-Cutting Plant

in the southwestern United States, but the most spectacular examples are the "haboobs" of Egypt and the Sudan.

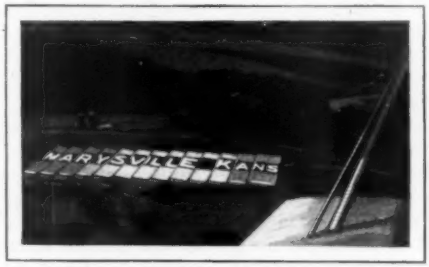
While the winds are the principal agency in charging the air with dust, there are several others. The countless meteors that enter the earth's atmosphere every day from outer space contribute their quota of dust, traces of which are found on the snowy summits of high mountains and on the polar ice fields. Forest fires, burning peat beds and other conflagrations on a large scale discharge great quantities of soot into the air. Cinders from the Chicago fire, in 1871, spread over a large part of the globe.

Another occasional cause of atmospheric dustiness is the eruption of volcanoes, especially those of an explosive character, which carry the dust up to levels where it cannot be washed out of the atmosphere by rain. The remarkable dry fog of 1783—the most famous in history—which covered the greater part of Europe and North America for three or four months—was due to the great eruptions of that year in Iceland and Japan.

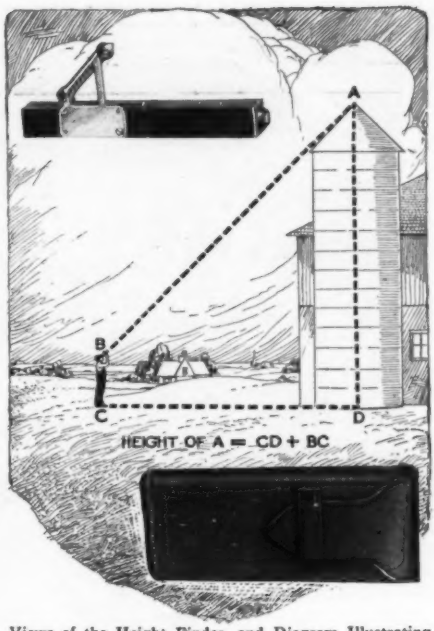
A persistent veil of dust in the upper atmosphere is believed to have a marked effect in lowering terrestrial temperatures. The fine grains of dust reflect back into space much of the short-wave radiation coming from the sun, but do not bar the passage of long heat waves radiated outward from the earth, so that, when the dust is present, the earth loses heat much more rapidly than it receives it.

SIX-HUNDRED-FOOT AIR SIGN AIDS HIGH FLYERS

Aviators flying as high as 5,000 feet over Marysville, Kans., have little trouble in identifying the town, for the name is painted in letters over fifty feet high on the roof of a large building. The sign is 600 feet long and seventy-five feet wide. The boy scouts of the town were instrumental in having the huge marker painted.



How the Boy Scouts of Marysville, Kans., Have Helped Aviators; Huge Marker as Seen from the Air



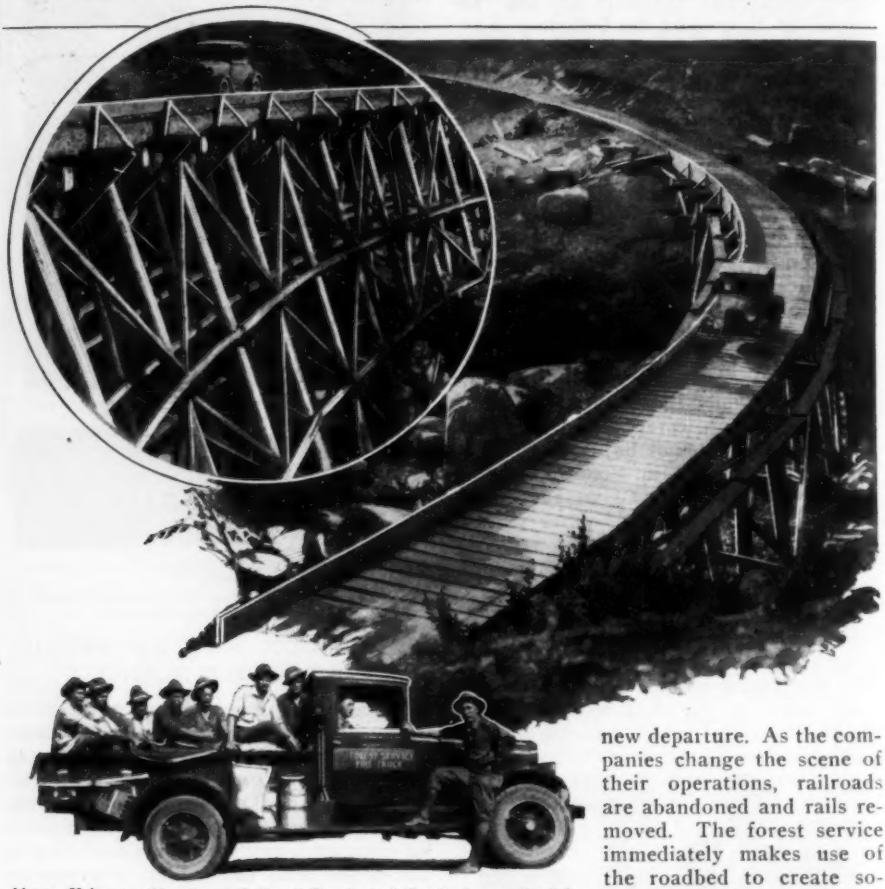
Views of the Height Finder, and Diagram Illustrating the Principle of Its Operation

HOW HIGH IS IT, ANSWERED AT SINGLE GLANCE

Simple and accurate in operation, a measuring instrument now is available which indicates the height of trees or poles from the ground, merely by sighting through it. The person operating the instrument stands away from the pole to be measured until a bubble and line in the device cross each other. The sum of the distance he stands from the pole and the height at which the instrument was held then will total the height of the pole. It is valuable to linemen and others who desire quickly to establish wire clearances, or heights of trees or buildings.

¶We want our readers to write us whenever they wish additional details on articles in this magazine. Address Bureau of Information.

ABANDONED TRESTLES TURNED INTO AUTO ROADS

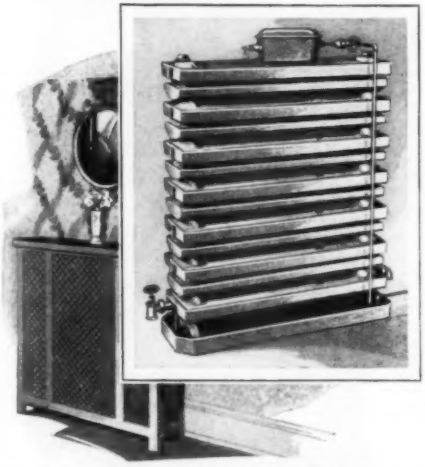


Above, Using an Abandoned Railroad Trestle and Roadbed as a Road for Forest-Fire Fighters; Below, One of the Fire-Suppression Crews

Ten thousand feet above the sea in the middle of a narrow trestle, where a twitch of the wheel to right or left means a plunge to death on the rocks and trees one hundred feet below; such is the place where you might find yourself if you set out to pursue the newly created suppression crew in its work of combating fires in the high country of the Sierra national forest in central California. The trestle is a vital part of one of the newest and most spectacular plans inaugurated for aiding in the quick control of forest fires. The work of two large lumber companies is being used to great advantage in this new departure. As the companies change the scene of their operations, railroads are abandoned and rails removed. The forest service immediately makes use of the roadbed to create so-called light-duty roads. A crew of men quickly clears away old ties and debris. An ordinary road scraper then completes the job, leveling the earth into an automobile road. The trestles, of course, require more attention. Two-inch planks, long enough to give a clearance of from eighteen inches to two feet, are nailed closely across the trestles to form bridges. In general, no railings are placed on the bridges, the routes not being intended for general use because of the lack of funds for maintenance. Although the roads are not open to the public, they may be traveled with a special permit from the government or the lumber companies.

HUMIDIFIER AND RADIATOR IN ONE UNIT

To provide the home or office interior with the proper moisture during the winter months, a combination radiator and humidifier has been introduced. Water is tapped from the house system and trickles down over the outside of the radiator, which is much like the usual article except that it consists of a series of troughs, giving a large evaporation surface. A valve prevents too much water from flowing out of the pipe and also insures a constant supply, so that no tanks or other containers have to be filled. Excess water runs off into the house drains. The entire unit is covered with an attractive screen when in operation, is noiseless, requires no attention and is obtainable in various sizes. Engineers state that it evaporates sufficient water to insure a healthful humidity at all times.



Combination Radiator and Humidifier Which Employs Running Water to Keep the Air Moist

These Trees Bordering a Highway Are Painted with a Phosphorescent Band for the Protection of Motorists at Night

TREES THAT GLOW AT NIGHT TO STOP ACCIDENTS

In order to prevent numerous accidents that have befallen motorists along some of the tree-lined roads of the Rhine region, German officials are painting the trees bordering the highway with a band of phosphorescent paint. The trees glow at night, and the driver is able to see them far enough away to avoid swerving into them.

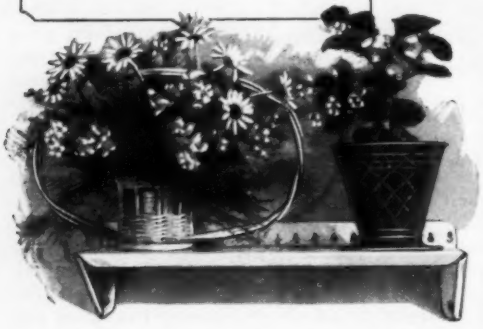
AIR-MAIL PILOT'S EQUIPMENT COSTS THOUSAND DOLLARS

Clothing and safety devices worn by some of the western air-mail pilots cost nearly $1,000. Wool shirt, boots and thick socks will total around $100. An all-leather coat adds $35 more; the flying suit itself often costs as much as $250, as it is leather and wool-lined, while the parachute and harness are worth $350. Moccasins, helmet and mittens cost $55, and the revolver adds $15. It takes some of the men as long as thirty minutes to get into the complete outfit.

Easier Ways

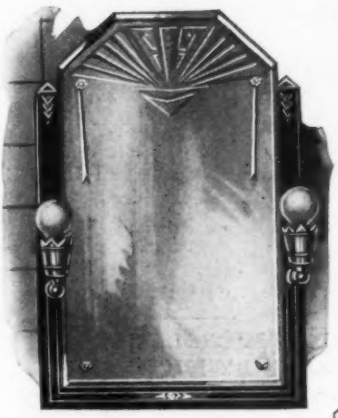
Here Is an Electric Clothes Drier That Folds Up as Shown at the Right When Not in Use; It Circulates 2,500 Cubic Feet of Air per Minute, Helping to Ventilate the House and Remove Cooking Odors; It May Also Be Used for Drying the Hair after Washing, or to Cool Foods

Electric Food Mixer Stands Up Alone in Bowl or Other Dish and Has Wide Range of Speeds for Ingredients of Different Kinds



Above Is a Convenient Reversible Metal Shelf That Hangs on the Heads of Two Nails and Will Support as Much as 100-Pounds; at Right, a Warm Rug with an Interlocking Fastener to Keep the Baby Snug and Safe; It Is of Wool and Attractively Trimmed in Colors

# of Doing It

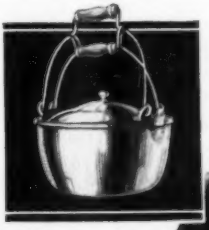


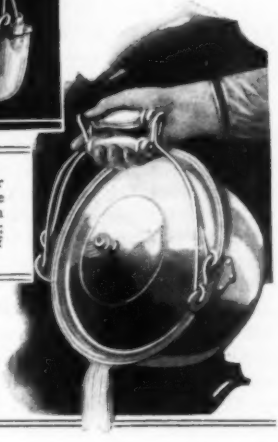
Easily Installed Mirror Cabinet for the Bathroom Has Edge Lights That May Be Moved to Various Positions along the Frame Simply by Pushing Them around the Slot; No Wires Are Exposed

© Keystone

This Baby Carriage Has a Specially Built-In Compartment for a Phonograph on Which Lullaby and Other Records May Be Played to Soothe or Amuse the Infant; a Cover Fits Tightly over the Instrument When Not in Use

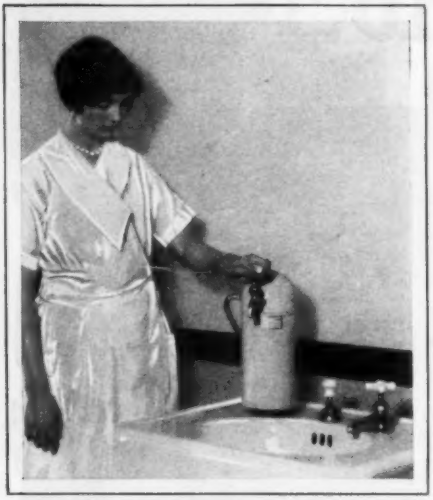
When the Door Is Opened, the Broiler of This Gas Range Automatically Slides Out and Will Not Tip or Fall; It Has a Drain to Carry Off Drippings and Thus Prevent Fires





Here Is a Safety Strainer Kettle That Protects the Hands as Shown When Pouring Off Hot Liquids; the Lid Will Not Slide Off

ELECTRIC HOT-WATER HEATER PLUGS INTO LIGHT SOCKET



An Electric Hot-Water Heater for the Bathroom Which Plugs into a Light Socket

Plugging in at a light socket is all that is necessary to obtain hot water with an electric heater which is intended for installation in the bathroom. It may be mounted either under or above the washbowl, is completely insulated and is equipped with a temperature control. It heats only the measure of water wanted, an automatic arrangement shutting off the current when the faucet is turned off. It is particularly adapted for shaving and other home uses, but also may be utilized by doctors, dentists and barbers.

FRUIT OF GIANT CACTUS TREE RELISHED BY INDIANS

Indians of the Arizona desert country have a natural sugar supply in the fruit of the giant sahuaro cactus. It is used mainly in the preparation of a sirup which is sealed in clay jars and keeps for a year or more. Harvesting the sahuaro fruits is an annual event. The women knock the ripe, red fruits from the tops of the tall cacti with long poles made of spliced cactus ribs and fitted with hooks fashioned from the thorns. The pulp is extracted by slitting the skins with a slash of the thumb nail. Fourteen or fifteen quarts of pulp represents a good half day's work. The men gather the fuel and haul the water for the camp fires over which the juice from the pulp is boiled until it is reduced to a sirup, suitable for sealing in the jars. Preserves are also made from the cactus fruit and seeds left over are either ground into meal or kept for chicken feed.

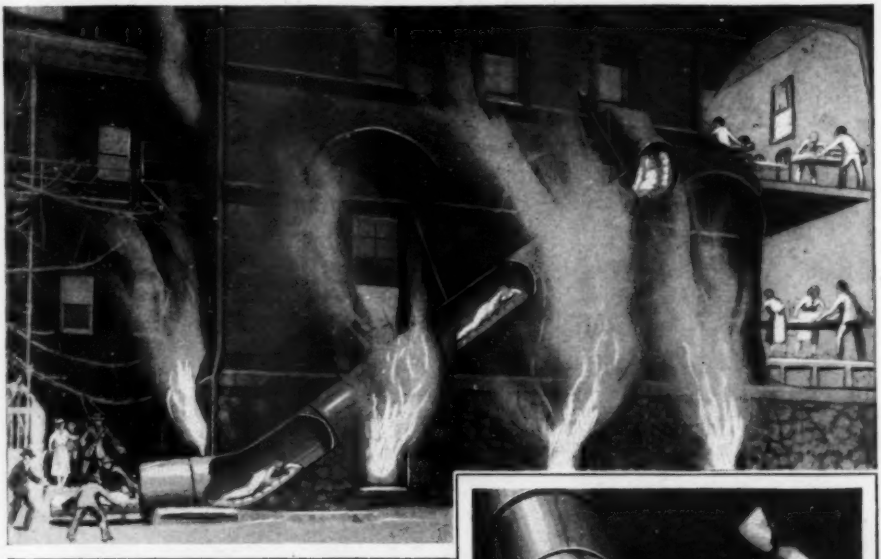
FOG DIAL ON CAPTIVE BALLOON TO AID PLANE LANDINGS

To assist pilots in landing on fields blanketed with fog, a western inventor proposes to send up a captive balloon until it floats in clear air. Directly beneath it would be a gauge giving the height of the balloon, the depth of the fog bank below and the height of the ceiling as well as the direction of the wind.

CANNIBAL MICROBES IN WATER SHOWN BY MICROSCOPE

Magnifying a drop of water one million times reveals ferocious cannibal microbes which make vicious attacks on other less hardy breeds, or even set traps for the unwary ones. One of the species is a "savage rotifer" whose pincerlike jaws devour other microbes, and another is a "bladderwort," which, although a plant, is a "meat eater," setting netlike traps for itinerant microbes. At the New York Museum of Natural History, a glass device which enlarges microbe life has been installed. Four years of work was necessary to make the model of life in a drop of water, which was blown in glass.

Some of the Cannibal Microbes Found in a Drop of Water Magnified One Million Times



Tubular Fire Escape Which Protects from Fire, Water and Smoke; at Right, Hospital Patient Emerging from the Tube

FIRE VICTIMS SLIDE TO SAFETY DOWN TUBULAR CHUTE

Intended primarily for hospitals, schools and other buildings where fire constitutes more than the ordinary hazard against life, a tubular fire escape, like a huge chute, down which the victims slide to safety, now is available. The chute is of steel construction and those trapped by flames step into it from doors on each floor of the building. Hospital patients may be sent down on mattresses and at the bottom come to a stop, ready to step out or be lifted out of the opening. Others may go through the chute much faster than down ordinary fire escapes, and are protected during the descent from weather, smoke and water, as well as from fire.

GLASS BULLETS FULL OF GAS USED BY SLAYER

Germany's police museum has acquired a pneumatic pistol used to fire glass bullets filled with deadly poison gas, the weapon used by a young Russian doctor to kill more than half a dozen victims, and finally himself. A woman first was found slain, her purse empty, but the cause of death a mystery. Four other persons were found under similar circumstances within a week, but one of the four recovered and said he saw a man step from a doorway and raise his hand. The others died from poison. Three more murders followed, but beside one of the victims the police found splinters of a thin glass bulb and suspicion was directed to the Russian doctor who had become suddenly wealthy. A detective put on his track was killed by the poison and when other officers raided the doctor's rooms, he began hurling the glass bullets, killing himself and all but one of the raiders. The glass bullets fired in the weapon were filled with a gas so deadly that it killed as soon as released.

Thrills in Hunting

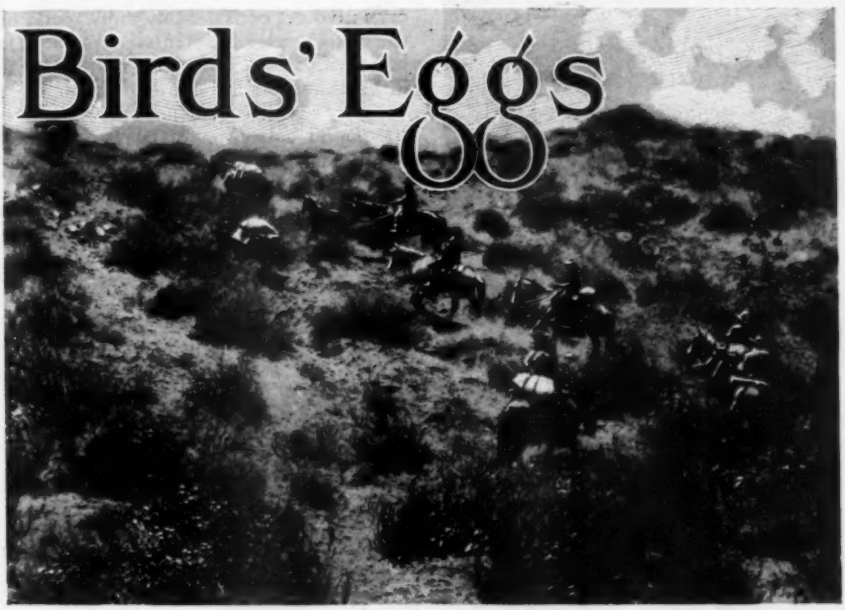
By H. H. DUNN

COMBINING the adventurous features of mountaineering, hunting and fishing with the necessity of varied knowledge of woodcraft, zoology and botany, and spiced with the danger of cliff and tree climbing, the collecting of birds' eggs, carried to its greatest development and value in the United States, offers a truly scientific sport. In desert and mountain regions, as well as on the islands off our coasts, the finding of birds' nests and the collection of their eggs require as great strength, endurance, ingenuity and scientific zeal as any kind of big-game hunting.

Approximately 10,000 persons—aside from the wild tribes who gather them for food—in the world are interested in collecting birds' eggs. Of these, there are not less than 3,000 in the United States. Scores are employed by museums and by wealthy private collectors; others make their own collections, devoting their attention largely to the birds of their own localities, counties or states. There are about 780 species of birds in the United States, and more than 10,000,000 of their eggs are in the public and private collections of this country. From a study of these eggs, and of the carefully kept notes

Rope Ladders Are Useful to the Egg Collectors; Right, Nest and Eggs of the Anthony Green Heron

Birds' Eggs



Expedition from the San Diego Museum of Natural History on a 1,000-Mile Trip through Lower California Hunting for Birds' Eggs; Extensive Expeditions Are Sent Out by Various Museums Each Year

of the many men, and a few women, who collected them, a very considerable part of our knowledge of the bird life of North America has been accumulated.

From them we have learned of the floating nests of the grebes and coots, the palm-fiber cradles of the hooded orioles, the habit of one of the flycatchers of putting a bit of discarded snake skin in every nest, the preference of the red-tailed hawk for sycamore trees, the reason that the meadowlark puts a dome of woven grass over its nest, why the dipper (water ouzel) makes a hollow ball of moss to house its eggs, that the long-eared owl steals the nests of hawks and crows to rear its young, and so on, indefinitely.

As previous collectors, since the days of Audubon, have paid particular attention to the number of eggs laid by each species of bird, the modern collector knows how many should be in the nests of the commoner species. When he observes that a bird has commenced incubation on a smaller, or larger, number than normal, this is a note of scientific interest. If he finds that this smaller, or larger, number persists over a considerable territory, the matter is of interest to evolutionists, who seek to learn the reason for the change in the normal "clutch" of this species of bird.

It is obvious that birds of prey have developed the habit of laying few eggs—two, three or four—because of the difficulty of providing fresh meat for a large family. But why do some of the ducks, notably the ruddy, deposit three to five more eggs than their bodies will cover? The condor, largest bird that flies, lays a solitary egg; the hummingbird, smallest of all the winged wanderers, lays only two, and sometimes one. The ostrich, largest of all birds of today, fills a hollow scraped in the sand with fifteen or more huge eggs; the common bobwhite, about the size of one toe of the ostrich, lays fifteen to twenty pure-white eggs. Who knows why?

Down precipitous cliffs, into caves, up towering wind-swayed trees, out on treacherous limbs, into quaking swamps, the egg collector goes to find his treasures, and, having found them, all he keeps is

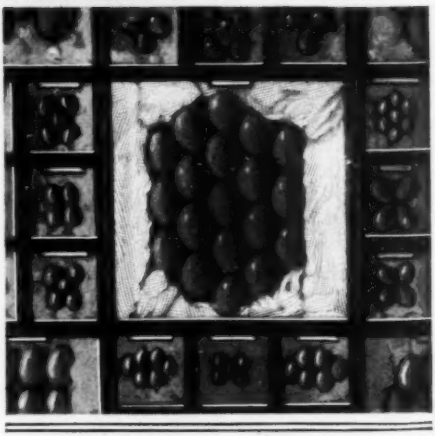
The second method of preserving the eggs involves considerably more work, but the results are more interesting and far more valuable. Here the nest—whether it be that of a hummingbird, no larger than a silver half-dollar piece, or the 100-pound collection of coarse sticks assembled by an eagle—is collected with the eggs. The larger nests are sewn together, in their original shape, in the tree or on the cliff, before they are taken from their resting place. Arrived at the home of the collector, or in the museum, they are placed in closed tanks and thoroughly fumigated, to destroy the abundant insect life which usually is to be found in them.

the shell. As the eggs are taken from the nest, each is marked. Then, every egg is wrapped in cotton and placed carefully in specially devised collecting boxes which give the utmost insurance against breakage. Most of the museums, and many private collectors prefer to keep the eggs in the nests, as found, so the nests must be collected, too, by recently developed methods. When the collector has reached his camp, or his home, he drills a very small hole in the shell and with a curved blowpipe, forces out the contents.

In the case of many of the birds of prey, and other flyers which build large nests in trees, part of the branch on which the nest was made also is collected. This, too, must be fumigated with the nest.

When the nests have been prepared, the eggs, blown, dried and marked as previously described, are placed in them and the

When the eggs have been cleaned and dried, they are preserved in one of two ways: Either in sealed, glass-covered trays in large drawers, or in the original nests in which they were found. In the first method, square cardboard boxes, heavy enough to protect the eggs, are provided, lined with cotton. Then the glass top is sealed on with black adhesive tape, after a few grains of some insecticide, usually naphthalene, have been sprinkled inside. Almost miscroscopic insects of several kinds attack birds' eggs and skins, and preservation of the specimen from these pests is only one of the troubles of the collector.

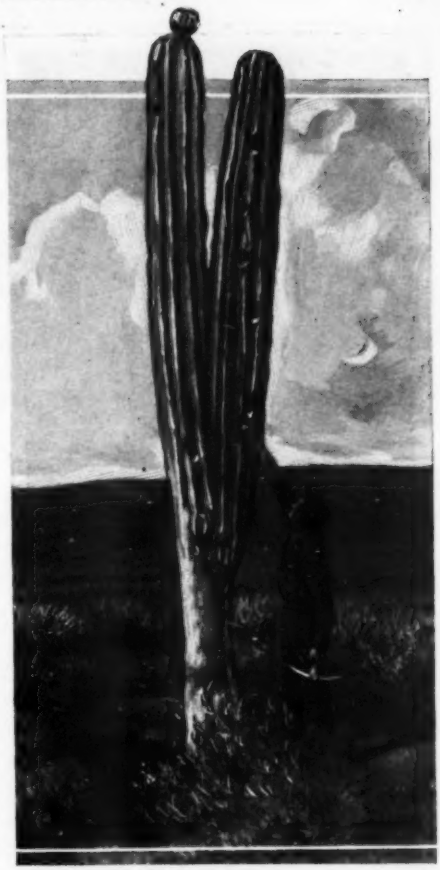


Top to Bottom, Raven's Nest and Eggs; a Female Snowy Heron on Her Nest, and Sample Egg Collection in Shallow Boxes

tops of the drawers either sealed on, or the standing or hanging nests left open. This method of preserving the eggs gives the student an opportunity to learn just what materials are used by various species of birds in building their nests, and how the only home builders in the world except man go about the construction of their temporary or permanent residences. A collection of eggs with the nests is about three times as valuable as the same collection would be without them. Smaller nests are collected with branches, clumps of brush, bunches of grass or reeds in which they are built. Woodpeckers' homes are preserved in the section of tree trunk which they have hollowed to suit their needs, and small doors are cut in the back of the trunk, to permit inspection of the eggs.

Most interesting of all is the method devised for the collection of the nests of some of the sea birds, such a gulls and terns, and some of the shorebirds, such as plovers, snipe, curlew, and others. These birds make little or no nest, merely scratching out a hollow in the sand, and lining it very rudely with bits of seaweed, moss or an occasional feather. The oyster catchers usually drag in a small shell or two with the eggs. Such birds trust to the protective coloration of their bodies and eggs to prevent discovery by enemies, and many of the terns and shorebirds will sit tight on their nests until almost trodden upon before taking to flight. Others fly away, run off with drooping wings, simulating injury, whenever man approaches, and it is almost impossible to see their sand-colored, brown-spotted eggs against the background of beach or sand spit.

When the collector finds one of these nests, however, he marks with a small twig a square around it, usually one foot to fifteen inches in each dimension, depending on the size of the nest hollow. Then he pours all over the sand on the inside of this square a quantity of very thin, colorless shellac, first having removed the eggs, but leaving nest, twigs, feathers and shells undisturbed. Marking the nest with a stick, so that he may find it again, and taking the eggs with him so that the bird will not again settle down on the nest, he leaves the shellac to soak into



Woodpeckers Carve Safe and Comfortable Nests in the Giant Cactus; Several Birds Make Their Homes in This Large Specimen

the sand for two or three hours, while he locates and similarly prepares other nests.

On his return, he finds that the shellac-soaked sand inside the square has hardened, and he is able to lift out the whole nest in a neat square of imitation sandstone. Any and all insect pests of course have been destroyed, and the nest is quite ready to be placed in the collection. It remains only to prepare the eggs, write up the record, and seal the specimens in the proper drawer.

The egg collector calls on the fireman and the sailor for his equipment in reaching the high-hung nests of some of the birds. A. M. Ingersoll, of San Diego, who has been building up his own private col-

Beautiful and Elaborate Nest of the Bush Tit, a Small Bird That Builds a Home a Dozen Times Its Size

lection of eggs of the birds of southern California for nearly half a century, has devised a folding ladder, made of steel, with a full extension of sixty feet. He has had made, from his own designs, a quite stable rope ladder which reaches ninety feet. The former is used on cliffs, in getting eggs of eagles, condors, hawks, owls, ravens, rock wrens and swifts.

Saws, hammers, strong cords, stout thread, and preservatives for birds' skins, eggs and nests also are part of the equipment of the modern egg collector, who must prove he knows his eggs and be a real student of ornithology before he can obtain license from the state as a collector. Virtually all the states now protect the eggs, nests and lives of the great majority of their birds, with the exception of a few hawks and owls, so that wanton collecting of eggs, nests or skins is a thing of the past. Scientific collectors have proved that when one nest and set of eggs are taken, the birds almost invariably build another nest and lay another clutch. This is never disturbed by the true collector.

Many collectors exchange with others in different parts of the world; some buy eggs from other collections, and a number, including most museums, employ salaried collectors of unquestioned reliability, to gather eggs and nests for them. Eliminating the eggs of extinct species, such as the great auk, Labrador duck and passenger pigeon, the highest-priced egg is that of the California vulture (condor), valued at $1,000 cash, or $2,000 in exchange for other eggs. At the other end of the scale lies the egg of the common English sparrow, placed at one cent. Rarity of species rather than difficulty of collecting sets the standard for these valuations.

Battles with condors, eagles and even some of the larger hawks, as well as with great horned owls, mark the lives of egg collectors. Climbing dizzy cliffs, creeping along narrow ledges, crawling into dark caves, sliding down hundreds of feet of rope, not knowing just how he will get back—all these are incidents in the scientific sport of gathering birds' eggs.

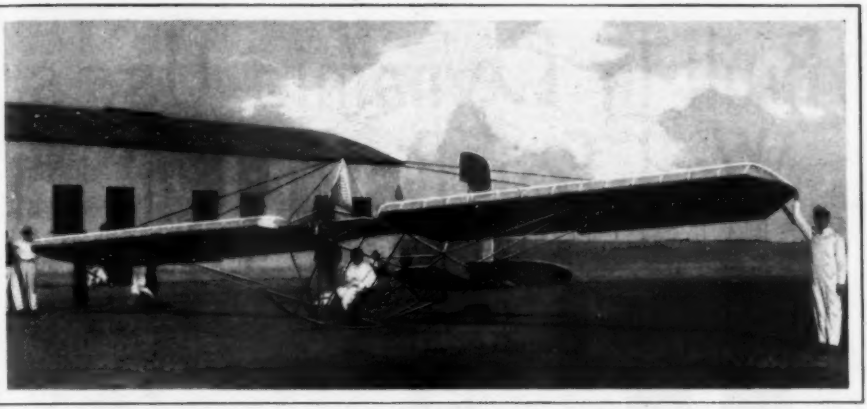
STREET CAR MOVED ON TRUCK WHEN AN AXLE BREAKS

Enabling two men to jack up a broken street-car axle and repair the damage sufficiently to allow the trolley car to proceed under its own power, an emergency truck for this form of trouble is in use in Cincinnati. The wheels of the truck are rolled into position on the track just in

Truck Placed under Street Car with Broken Axle, Enabling It to Proceed under Own Power

front of the street-car wheels, and the car is lowered onto the emergency truck which weighs 445 pounds, while axle and wheels weigh 290 pounds. The outfit is carried in a motor truck to the scene of trouble and, when it is in place, a street car with broken axle can proceed at normal speed for several miles.

¶ Whales are being killed off at the rate of 30,000 a year.



Glider Equipped with a Forty-Horsepower Motor Which Gets into the Air More Quickly Than an Airplane and Lands at a Safe Speed of About Fifteen Miles an Hour

GLIDER EQUIPPED WITH MOTOR LANDS AT LOW SPEED

Propelled by a forty-horsepower motor, a glider recently underwent successful tests in California. The maker claims the craft, driven by its engine, will take off in one-fifth the time and distance required for an airplane, and will glide to a slow, safe landing at fifteen miles an hour after attaining an altitude of 10,000 feet.

RADIO WAVES SLAY INSECTS LABORATORY TESTS SHOW

Victory over one of man's most dangerous and destructive enemies, the insect, and an important new use for radio are promised as a result of interesting tests with high-frequency radio waves at the New Jersey agricultural experiment station. Investigators found that such waves killed cockroaches, beetles, house flies and other insects in short order. The invisible impulses, emitted on a wavelength of about twenty-four meters and with a frequency of nearly 12,000,000 cycles a second, developed heat of a deadly degree within the bodies of the insects, producing death in a short time. The German cockroach proved to be the most difficult to defeat by this means, nearly two and one-half minutes being required before it was killed. Apparently, the tissues in the bodies of the insects reacted to the high-frequency waves in such a manner that heat was speedily generated. The subjects became warm to the touch after a few moments' exposure to the radio. Scientists see a wide application of the system if the method followed in the preliminary laboratory tests can be applied to general use.

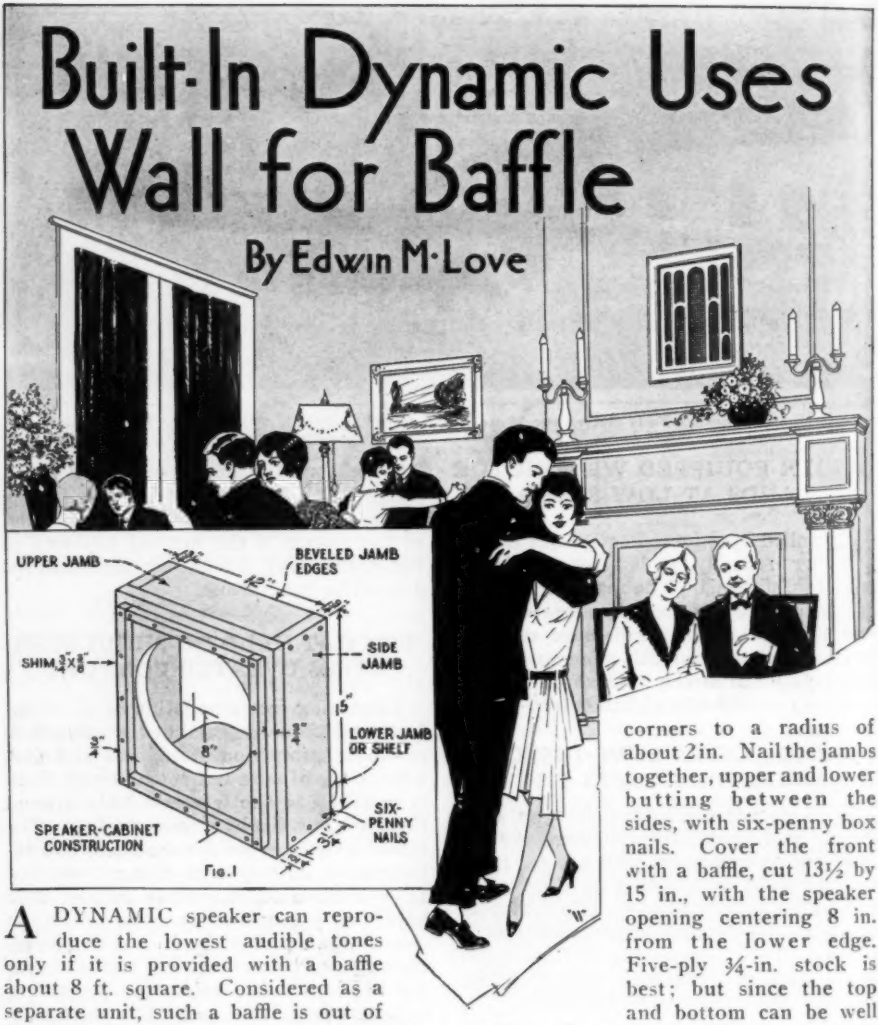
SUN HAT HELD ON SHOULDERS GIVES GREATER COMFORT

Permitting free circulation of air about head and shoulders, and at the same time affording protection from heat and sun, a hat made of wire and covered with cloth is attached to the wearer's body around the chest or waist by means of a belt. The light frame rests on the shoulders and interferes in no way with free movements. It is collapsible, the same springs that hold it in position when open, keeping it closed when pushed back over the head. Netting can be used with it to transform the hat into a bee helmet or protection against mosquitoes and other insects.

Sun Hat of Wire and Cloth, Which Rests on Shoulders, to Give Comfort to Wearer

Built-In Dynamic Uses Wall for Baffle

By Edwin M. Love



A DYNAMIC speaker can reproduce the lowest audible tones only if it is provided with a baffle about 8 ft. square. Considered as a separate unit, such a baffle is out of the question for the average house; but there is no reason why a wide partition space cannot be utilized for the purpose if the projection of the speaker back can be made into a closet, hall, or other room where it is not noticed.

Figure 1 illustrates a cabinet for holding speakers up to 10 in. in diameter. Smooth two pine side jambs, ¾ by 3¼ in. by 15 in., and an upper jamb, 12 in. long. The lower jamb must be of sufficient width to accommodate the base of the speaker. For neatness, round the outside corners to a radius of about 2 in. Nail the jambs together, upper and lower butting between the sides, with six-penny box nails. Cover the front with a baffle, cut 13½ by 15 in., with the speaker opening centering 8 in. from the lower edge. Five-ply ¾-in. stock is best; but since the top and bottom can be well nailed to the jambs, solid stock is fairly satisfactory.

This cabinet will fit between two studs in the wall, leaving a little side clearance for plumbing. For the best appearance in the wall, the grill should be noticeably above or below the center of the room height; but do not, on this account, reduce the effective size of the wall baffle. If the grill must be centered on the wall, a table or stand under the grill will make centering less noticeable.

Cut the plaster on the wall back first, lay-

ing a canvas or paper on the floor to catch the litter. To locate a stud tap on the wall with a hammer; the sound between studs is hollow, and becomes more solid as the stud is approached. Drive a small nail well to the side, and with a cold chisel cut out the plaster until the stud side is reached. Then plumb a pencil line for the side of the opening. The inner face of the other stud will be found 14 to 14½ in. from the first. Plumb a line there also. Level across for the bottom and top of the opening. With a cold chisel, chop away the plaster, or cut both it and the laths with a compass saw. Cut two pieces of 2 by 4-in. stock for trimmers, which are to be toenailed between the studs behind the plaster and flush with the edges of the opening.

Locate the grill opening in the other side of the wall, by driving four nails ¾ in. from sides, top and bottom. Cut the opening from the room side.

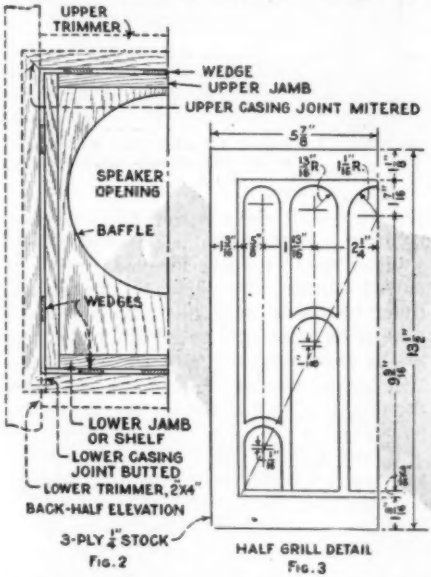


FIG. 2

HALF GRILL DETAIL
FIG. 3

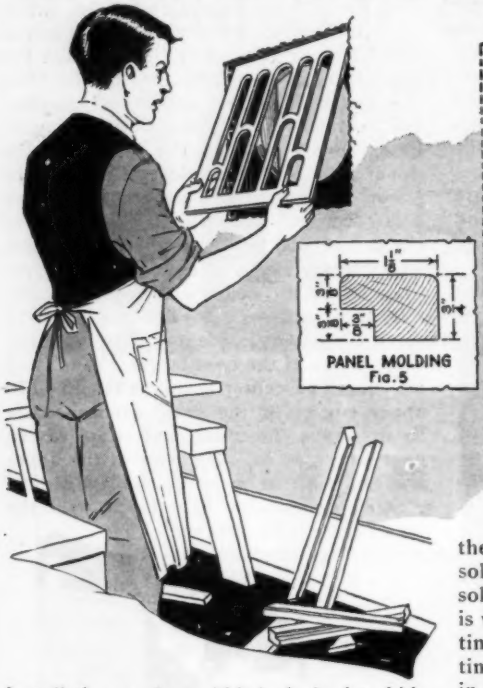
Now set the cabinet by wedging it between studs and trimmers with thin strips of wood. Drive six-penny finish nails through the jambs into the framing, being careful to keep the jamb edges flush with the plaster and the sides plumb. Cover the joint with the wall with a ¾ by 1¾-in. casing, nailed to the side and top jambs, with inner edges flush with the inside of the cabinet. Nail the outer edges into the studs and trimmers. Miter the upper joints, and butt the lower, using a 1-in. casing below the shelf. Finish by rounding the corners.

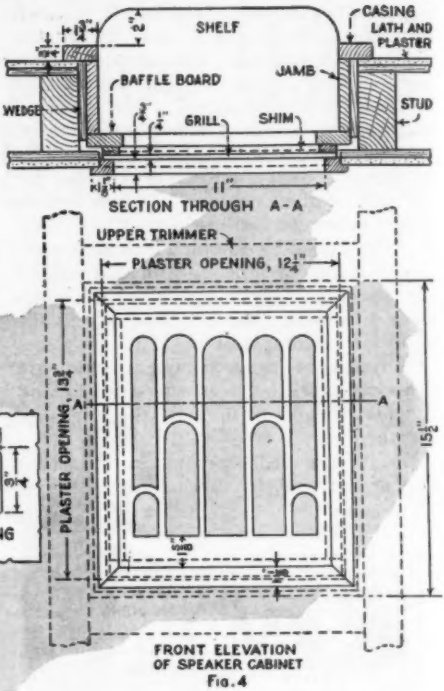
Figure 3 details the grill. This is an 11¾ by 13½-in. rectangle of ¼-in. three-ply hardwood, preferably of material matching the trim of the room. On the front face, gauge pencil lines 1⅜₁₆ in. from the lower edge and sides, and another 1⅛ in. from the top, forming the layout base. From a point 1⁷⁄₁₆ in. below the upper line, on the vertical center, to the lower corners, draw two oblique lines. Draw vertical lines 2¼ in. each side of the center, and two more 1¹³⁄₁₆ in. beyond. The intersections of these with the oblique lines locate the centers of the small cut-out arch undersides. The radii of the small arches are, inside, ⅝ in., and outside, 1 in.; those of the next larger, ¹³⁄₁₆ in., and 1³⁄₁₆ in. The center radius is 1⅛ in. The upper curves of the small arches center ⅛ in. above the inner, and those of the next larger, ⅛ in. The tops of the upper arches are all ³⁄₁₆ in. below the layout line.

Stretch a suitable light fabric over the back of the grill, and nail the latter to the baffle, us-

ing ⅜-in. shims, or strips of any necessary thickness, to bring the face within ⅜ in. of the plaster. Cover the joint with a casing of panel molding (Fig. 5), made by rabbeting a ¾ by 1⅛-in. strip ⅜ by ⅜ in. and rounding the corners.

Paint the wood to match the trim, and





install the speaker. If it is desired to hide the back of the unit, hang a small curtain from a rod above.

Caring for Electrolytic B-Power Units

Many of the electrolytic B-power units are in use and it has been the experience of the writer that they perform in a very satisfactory manner when proper care is taken of them. Add distilled water to the jars occasionally to take the place of that which has evaporated and use a clean hydrometer, kept for this purpose only. This is important because if there is the slightest trace of battery acid added to the solution in certain types of power units, it will render the unit inoperative. When the solution becomes thick and filled with solid matter, it is time to discard it. Rinse the jars with clean water and add new solution. Be sure to use the particular solution that is made for your unit. It is well to renew the electrodes at the same time. Remove only one electrode at a time so as to be sure to get the right kind in the same position. Replacement solution and electrodes can be obtained from the manufacturer of the unit or the dealer handling the device.

When testing the output voltage of any type of power unit, use only a high-resistance voltmeter (1,000 ohms per volt). They cost a little more than the common type but must be used in order to get a correct reading. The cheaper type will give a reading 5 or 10 volts below normal, owing to the greater current taken by the low-resistance meter. When working with any type of power unit, always disconnect it from the line-supply first. Check all binding posts to make sure that they are secure and free from corrosion, as a loose contact will cause noise and loss of power. When starting the unit in operation, adjust the detector and

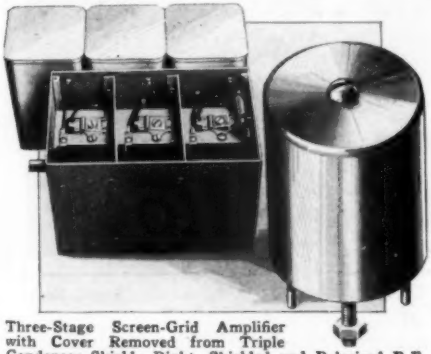
amplifier voltages for best signal strength and quality of reproduction. After this adjustment is made, it is seldom necessary to change it, and the device is usually better left alone.—R. J. Plaisted, Cleveland, Ohio.

Soldering Iron Permanently Tinned

To tin a soldering iron permanently, take it to a jeweler and have him tin the point with silver solder. This has a higher melting point than lead solders and the point will stay tinned. It is best to let a jeweler do the job unless you are accustomed to using hard solder, and the cost is usually only about 50 cents.

New Screen-Grid Unit for Experimenter

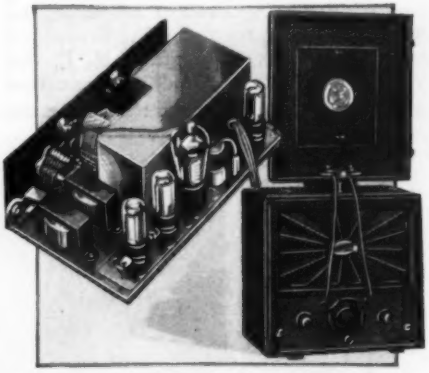
A three-stage, high-gain screen-grid r.f. amplifier, completely assembled, wired and tested, is now available to the home constructor. The unit is designed for maximum r.f. amplification over the entire broadcast band and is said to be absolutely stable with consequent absence of regenerative distortion. It consists of a matched triple condenser of the "battleship" type in an aluminum shield; three sealed copper cans, each containing a high-gain r.f. transformer and a polarized r.f. choke; metallized gridleak and mica grid condenser. Pigtail leads are taken from the bottom of the unit for connections beneath the subpanel. The chokes used are



Three-Stage Screen-Grid Amplifier with Cover Removed from Triple Condenser Shield; Right, Shielded and Polarized R.F. Choke Coil

specially designed for screen-grid tube operation; they are thoroughly shielded in an aluminum shell and polarized.

Portable Set Operates on Direct or Alternating Current

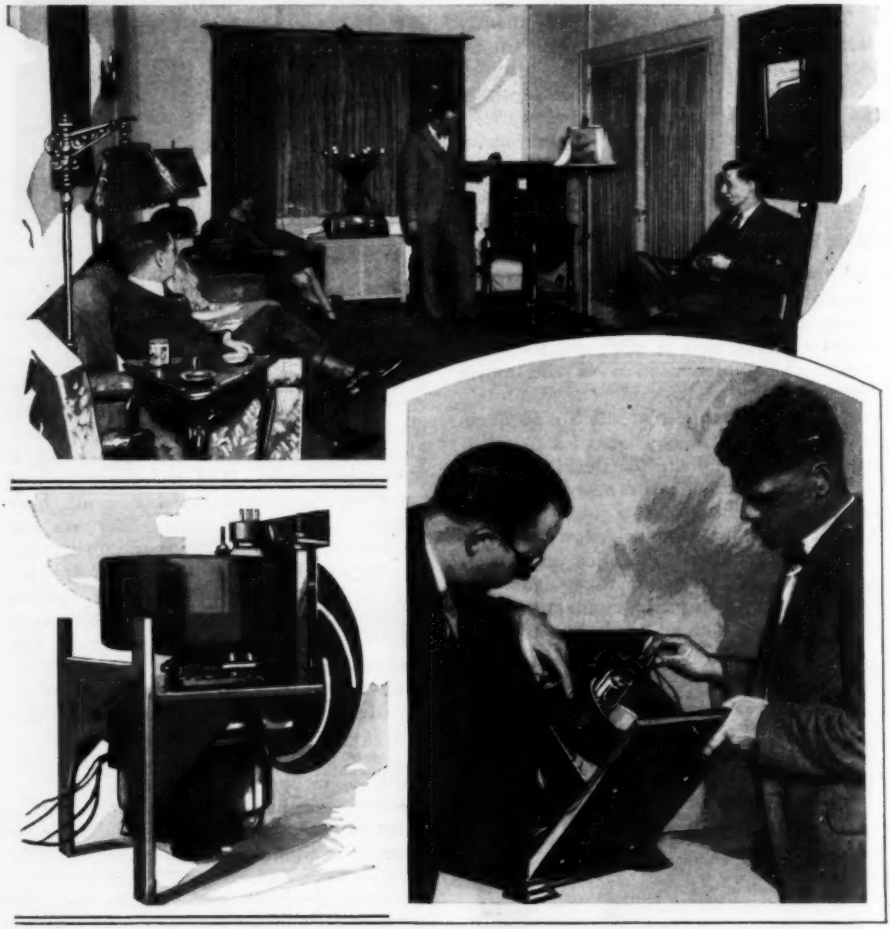


Left, Tubes in Position; Right, Complete Portable Receiver for Either A.C. or D.C. Operation

A portable receiver that will meet any current requirements is a departure from the usual portable, which depends entirely on batteries for its operation. The receiver shown in the accompanying illustration is one of three models which employ an efficient shielded circuit and a screen-grid tube. The power packs and batteries are interchangeable in all three models, so that the owner may use the set, regardless of location or power supply, by adapting it for either 110-volt alternating or direct current, or, where neither of these are available, by using batteries instead. The sets are of the four-tube type and employ one dial for tuning, with a small trimmer condenser provided for use in congested broadcast areas and for separating near-by stations on very close wavelengths. The small model is intended chiefly as a battery-operated set, but can be equipped with either of the power packs which come as separate equipment. Fully equipped, this small model weighs only 27 pounds. Type-199 tubes are employed for the first a.f. and detector stages, a screen-grid tube in the r.f. stage, and a type-120 tube in the last audio stage. The larger models are intended for use with a power tube in the last stage and for a.c. or d.c. operation. The speakers are considerably larger than the one used in the smaller model so as to handle the greater volume delivered by the more powerful audio system.

Television at Low Cost Now Possible

With the development of a simplified and relatively inexpensive televisor, the inauguration of regular sight broadcasting service from Jersey City, N. J., and Washington, D. C., and a production schedule well under way, an eastern television corporation is in a position to introduce television into the home. The apparatus is, of course, suitable for reception also from other stations using the same standard transmitting methods. Tests during the past six months have resulted in a televisor which combines a simplified scanning drum with a selector shutter, simpler, quieter and less expensive than the previous models. Far better detail in movies or silhouettes and very satisfactory half-tones are possible with this new televisor. The scanning drum is mounted at the top of the receiver and contains a vertically mounted neon glow lamp; the synchronous motor is below the drum and the selector shutter is mounted at the front of the assembly.

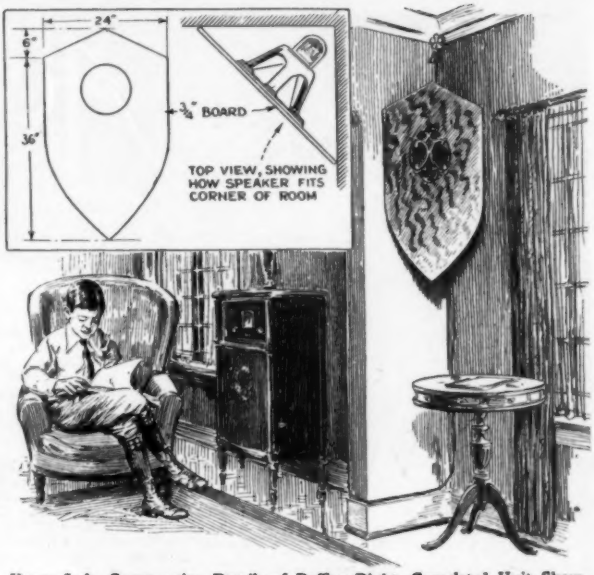


Television in the Home: Lower Left, Scanning Drum, Motor and Selector-Shutter Assembly; Right, Engineers Examining the Installation by Opening the Rear Door of the Cabinet

The equipment is reduced to the simplest parts, yet the performance is remarkably improved.

A Corner Baffle for the Dynamic Speaker

Dynamic speakers now in vogue require a large baffleboard for maximum results. This means that the owner of a speaker of this type must either place it in a large cabinet or mount it behind a cumbersome and unsightly baffle. A simple solution of the problem is an ornamental baffleboard, carrying the speaker, mounted in a corner of the room as shown. All that is required is a suitable board with a small shelf at the rear to support the weight of the speaker. The baffle may consist of a nicely grained piece of hardwood, suitably stained, varnished and finished, or it may be a section of insulating lumber, on which plastic paint can be applied in any ornamental way. A suitable shape is the shield detailed in the diagram. The hole for the speaker may be cut in the form of a grill or a circle backed with silk or tapestry glued to the back of the baffle. The speaker is then mounted on the shelf which is supported with small brackets and screwed down in such position that the cone housing presses firmly against the baffle at the rear. A screw-eye at the upper end of the baffle is provided for a rosette suspension cord of the type used for hanging heavy pictures. The walls of the room diverging from the baffle have the effect of adding baffling surface and aid in bringing up the low notes, in which this type of speaker excells when properly installed.—Harry G. Schultz, Astoria, Long Island, N. Y.



Upper Left, Construction Details of Baffle; Right, Completed Unit Showing Method of Installation

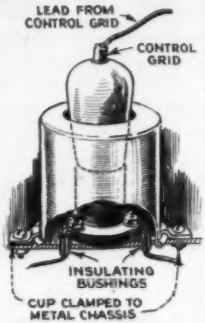
New Unit Eliminates Line Noise

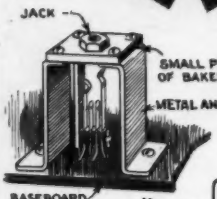
Crackling and sizzling noises, which may be caused by defective electrical apparatus in operation at some point distant from the receiver, are often communicated to the set by the lighting line which supplies power for both units. The instrument shown in the illustration is designed to eliminate interference of this nature. The plug from the receiver to the power-supply line is removed from the wall outlet and the plug from the device substituted for it. The connection from the receiver is then made to a receptacle in the top of the interference eliminator, and the receiver operated in the regular manner. Should the interference still persist, an extra wire may be connected to the binding post on the front of the device and connected to the ground on the set.

¶Popular Mechanics radio department offers its information service free.

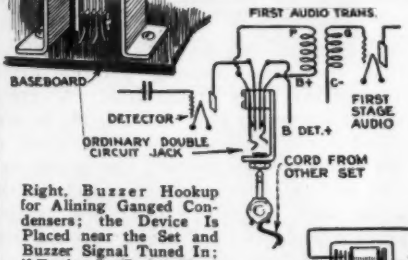
Across the

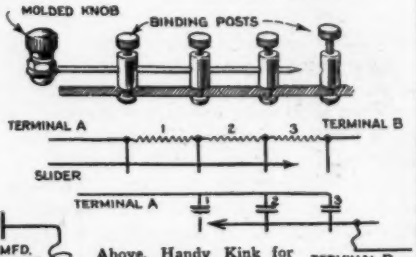
Left, for a Good Antenna Joint, Wrap Lead-In Wire as Shown, Leaving 2 In. Parallel to Horizontal Wire and Solder Together; Right, Aluminum Drinking Cup Makes Good Tube Shield



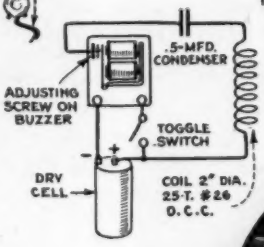


Left, a Handy Jack Assembly for Making Amplifier Unit in Broadcast Receiver Available for Use with Short-Wave Adapter or Phonograph Pick-Up; the Double-Circuit Jack Is Mounted at the Rear of Subpanel and the Diagram, Showing All Connections, Is Given Below

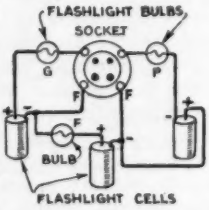




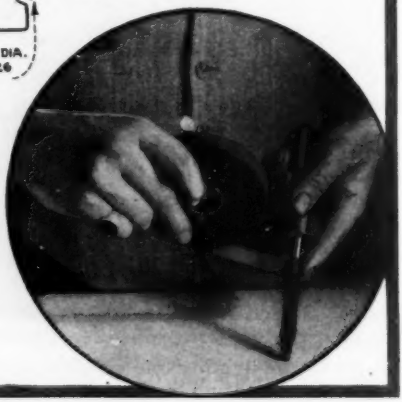
Right, Buzzer Hookup for Alining Ganged Condensers; the Device Is Placed near the Set and Buzzer Signal Tuned In; if Tuning Is Broad, Move Device Away Until Sharp, Loosen Separate Rotors and Vary Them Until Signal Strength Is Maximum; Then Lock Rotor Plates in Position



Above, Handy Kink for Cutting Resistors in Series and Condensers in Parallel In and Out of Experimental Hookups

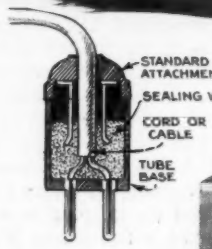


To Prevent Expensive Short Circuits When Making Adjustments in Receivers, Tape the Screwdriver as Shown in the Photo

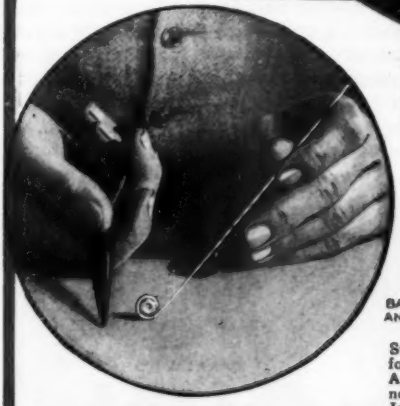


To Test Radio Tubes for Short Circuits, Insert Tube; if Bulb F Lights, Bulbs G and P Should Not Light; G Lighted Indicates Grid-Filament Short; P Lighted Shows Grid-Plate Short; to Clear Short in Either Case, Tap Tube, and if Lamp Continues to Burn Discard Tube; Many Elaborate Tube Testers Do Not Indicate Shorts

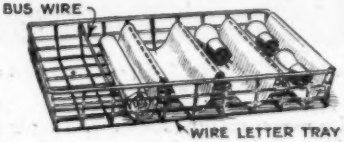
Radio Bench



Connector Plug for Tube Testers or for Short-Wave Adapters

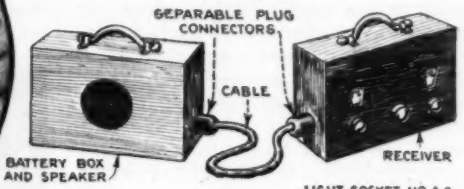


Threading Nuts behind Panels and under Instruments Is Simplified by Bending a Length of Busbar Wire to Hold the Nut

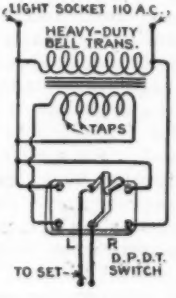


A Wire Letter Tray Converted into a Vacuum-Tube Holder; Busbar Wire Forms the Partitions and the Covering Material Is Felt or Woolen Cloth; the Holder Should Be Fastened to the Bench

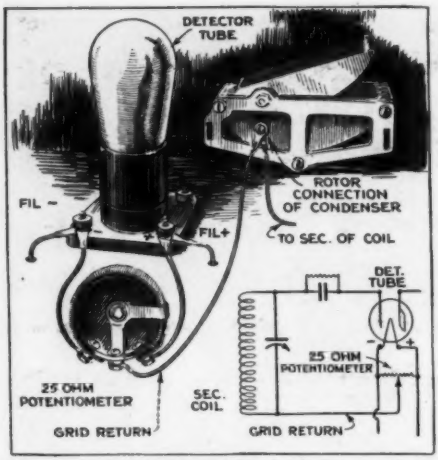
To Check Audio Distortion, Connect an 0-50 Milliammeter in Negative-B Lead. Tune in Strong Signal; if Pointer Pulsates Upward from Normal Position, There Is Excessive C-Bias; to Correct, Increase B-Voltage on Last Tube



Suggested Two-Unit Installation for Portable Receiver; by This Arrangement a Good-Sized Magnetic Cone-Speaker Unit May Be Installed in the Battery Box without Crowding the Apparatus in the Receiver Proper



Right, a Simple Device for Correcting Low A.C. Line Voltage Conditions; the Bell-Ringing Transformer Is a Heavy-Duty Type and Boosts the Voltage by Steps of 6, 12 and, in Extreme Cases, 18 Volts; the D.P.D.T. Switch Controls the Set Voltage between Light and Heavy-Load Periods; When Load Is Light, as in Daytime, Throw Switch to Position R; When the Heavy Line Load Is On at Night, Throw the Switch to L; the Line Voltage Should Be Checked at Both Periods before Installing This Device



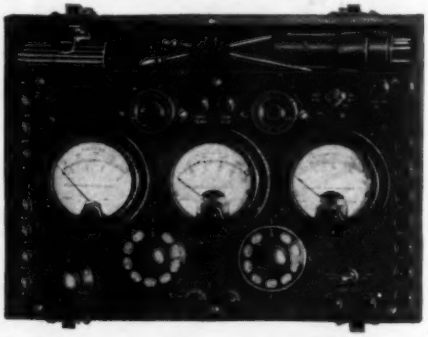
Left, Picture Diagram Showing All Connections; Right, Schematic Circuit Diagram

Stopping A-Eliminator Hum

The A-eliminators now in common use in adapting standard battery-operated sets for a.c. operation, in connection with B-eliminators, are practical and efficient and very little hum is present in the usual installation. In some circuits, however, the hum may be annoying, and in these cases there is a simple remedy which the writer has found effective. In this particular A-eliminator there were eight taps, so that, by means of a switch, a different tap could be used to compensate for line variations and also for different types of receivers. A slight hum could be heard when using the first tap and as the switch was advanced to the point for the correct operation of the receiver, the hum became more pronounced and annoying. To solve the problem, after trying a number of advised suggestions without avail, as a last resort I decided to try the system employed in a.c. sets; that is, connecting the grid return to the electrical center of the tube filaments as shown in the diagram and sketch. There are several types of strip resistors with variable center taps on the market that may be used for the purpose of balancing out this hum. In the writer's case a 25-ohm potentiometer was available and answered the purpose nicely. The center post is connected to the slider arm so that, by moving the slider from left to right, the electrical center where the hum disappears is easily found and the potentiometer is then left at this setting. In my case it was only necessary to use the center-tapped resistor across the filament of the detector tube.—Henry S. Laraby, New Haven, Conn.

Portable Instrument Makes Testing Easy for Service Man

A combination set tester can now be had contained in a rugged bakelite case provided with a carrying handle and a compartment for the set accessories and a few small tools. It has a removable snap-on cover, and the over-all size is 12⅜ by 9 by 3¾ in. The weight is approximately 10 pounds. A UX and UY-socket are provided on the panel, the tester plug has four prongs, and an adapter is provided to change it to a five-prong plug. Rotary switches are used to make the various voltage ranges available and binding posts are supplied for external tests using flexible test leads which come with the set. Two binding posts and a 4½-volt C-battery are provided for use in making continuity tests with either a high or low-resistance voltmeter. The resistance is changed by means of a toggle switch, so that either 1,000 or 100 ohms' resistance per volt may be placed in the circuit.



Combination A.C.-D.C. Set Tester for the Service and Repair Man

Simultaneous readings can be made of the heater voltages on the a.c. voltmeter and the plate current on the milliammeter, while plate, grid bias, cathode or screen voltages, or the grid, screen or rectifier currents are being measured on the d.c. volt-milliammeter.

Filament Supply from 32-Volt Source

Many homes in suburban and rural districts have 32-volt electric plants and in such localities, where battery-operated receivers are in use, an efficient method of obtaining the filament supply directly from the 32-volt outlet will be appreciated. The simple reducing unit shown in the sketch may be mounted on a small bakelite panel and baseboard and installed in a well ventilated receiver cabinet, doing away with a separate battery and the bother of charging. The current supplied by this type of electric plant is usually sufficiently constant to give a good quiet source of filament supply if a little filtering is afforded. In order to keep the noise at a minimum, a filter choke coil, made by winding 100 turns of 12 gauge, single-cotton enameled wire on a piece of iron pipe, 2 in. in diameter and 5 in. long, is connected in the line, as shown in Fig. 1. The 1-mfd. filter condensers are connected across the line on each side of the choke, and the remainder of the unit is the voltage-reducing device. The values of the fixed and variable voltage-reducing resistors will be determined by the current drawn by the particular receiver with which it is to be used. The table, Fig. 3, will enable one to select resistors for specific requirements, but, as the sets used in these localities, as a rule, are of the five-tube type, employing 201-A tubes, the writer has used a set of this type as an illustration. Employing five tubes drawing ¼ amp. each, the full current load is 1¼ amp. Referring to the first column of the resistor table we find that a set drain of 1¼ amp. requires a fixed resistor, No. 1, of 10 ohms and No. 2 of 5 ohms. Variable resistors Nos. 1 and 2 are of the 6-ohm type and are capable of carrying the total current of the receiver without overheating. If tubes of the 199-type are used, the fixed resistors No. 1 and No. 2 are 35 and 10 ohms respectively, and the variable rheostats are 25 ohms each. When this device is installed, remove the ground wire from the receiver, as the set is already grounded at the light plant. If the set must be grounded for best results, use a 1-mfd. condenser in series with the set and ground, to prevent the possibility of a short circuit.—D. A. Brown, Marion, Ohio.

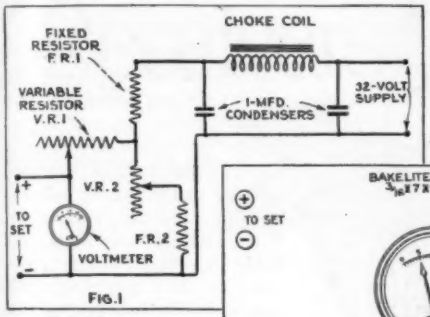


FIG. 1

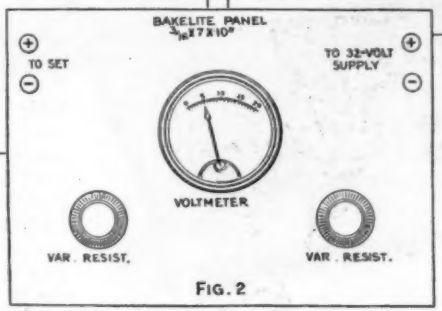


FIG. 2

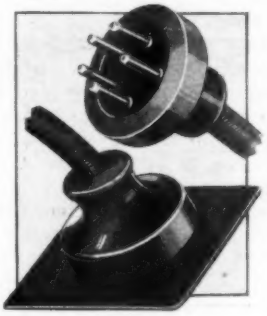
RESISTOR TABLE

RECEIVER CURRENT DRAIN	F.R.1	WATTAGE RATING	F.R.2	WATTAGE RATING
.75	12.5	60	5	60
1.00	12.5	60	7	60
1.25	10.0	60	5	60
1.50	10.0	60	7	70
1.75	6.5	150	3.5	70
2.00	6.5	150	3.5	70
2.25	5.5	150	4.5	70
2.50	6.5	150	6.5	70

FIG. 3

Connector Plug for Power Packs

This semi-soft rubber connector plug should appeal to the experimenter as well as the set manufacturer as an inexpensive yet effective method of connecting a chassis or dynamic-speaker field to the power pack. The receptacle used is a standard tube socket, either four or five-prong. The plug will also lend itself to many other similar uses.



New Settings

THERE are some twenty million radio sets in use in America and they are all pretty much alike. To be sure, some are consoles, some table models and some cabinets, but whether they stand on floor or table, they are cut more or less to the same pattern and most of them look better on the dealer's floor than in the home.

The modern radio chassis is so compact that it offers almost unlimited opportunity for unusual treatment. For instance, the little end table illustrated in the headpiece to the left not only holds magazines and a full shelf of books, but houses a complete six-tube screen-grid radio, power pack, amplifier and dynamic speaker. The tuning controls are at the top. The set may also be mounted in a bookcase, as shown on page 307. In this installation the panel, imitating a row of books, was made at a bookbinder's, and the set simply slid into place.

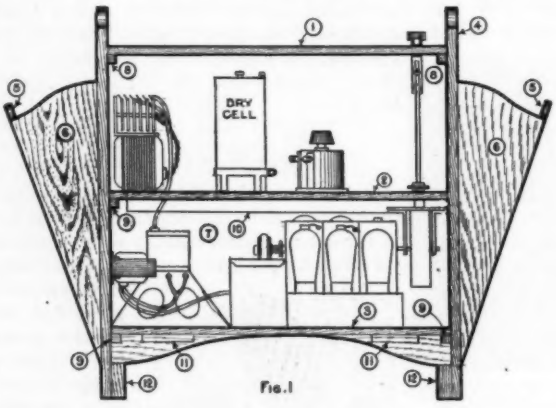


Fig. 1

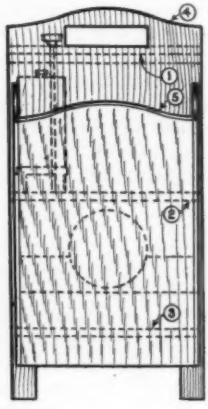


Fig. 2

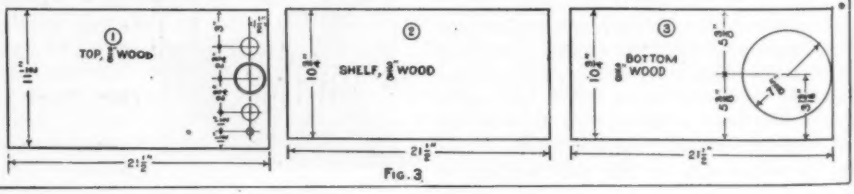
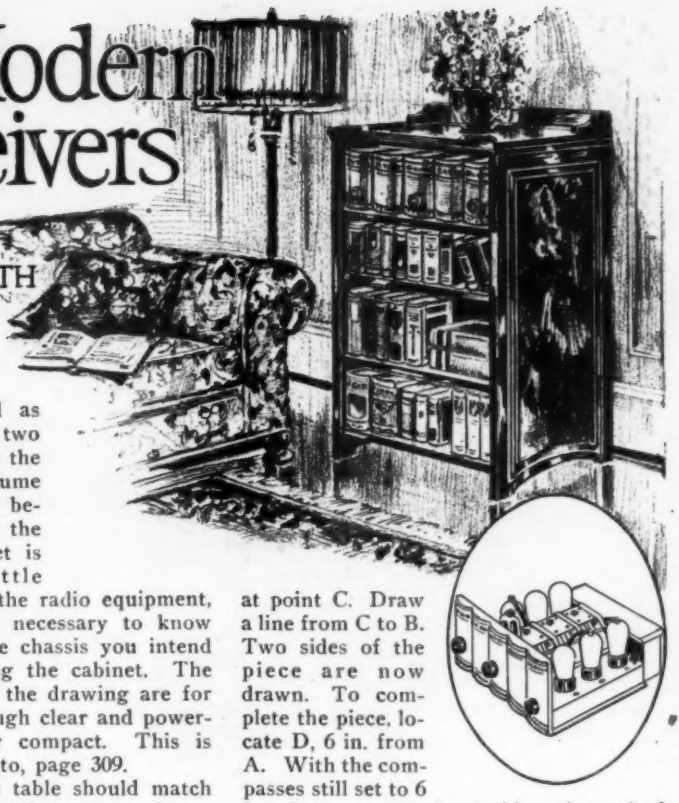


Fig. 3

for Modern Receivers

By GRAYDON SMITH



The magazine stand, Fig. 1, has been found very satisfactory, as well as easy to build. The two knobs at the top are the tuning and the volume controls. The meter between them shows the wavelength the set is tuned to. Very little space is allotted to the radio equipment, and it is absolutely necessary to know the exact size of the chassis you intend using before building the cabinet. The dimensions given in the drawing are for a chassis which, though clear and powerful, is exceptionally compact. This is shown in center photo, page 309.

The wood for the table should match the other furniture in the room as far as possible. Mahogany, walnut and gumwood are easy to work and finish well. Two pieces, 10 ft. long, 1 ft. wide, and ⅜ in. thick, will be needed for the top and sides of the table. This does not include the door on the back, which is not visible and is made of cheap plywood, ⅜ in. thick. Although the little pieces which complete the legs are shown ⅝ in. thick, they may just as well be built up of scraps from the other pieces.

The pieces are laid out on the finished boards in pencil, then cut out with a keyhole saw, coping or jig saw. Most of the pieces are very easy to lay out, but a few words about 6, Fig. 1, may be of help. In laying out these pieces, first draw the straight line AB, Fig. 5, 17⅝ in. long. Set a pair of compasses to this radius and draw an arc about point B. Then set the compasses to 6-in. radius and draw an arc about point A. These arcs intersect at point C. Draw a line from C to B. Two sides of the piece are now drawn. To complete the piece, locate D, 6 in. from A. With the compasses still set to 6 in., draw an arc about this point. And finally with the compasses set to 7 in. find a point on the line BC, about which a circle can be drawn that will join smoothly

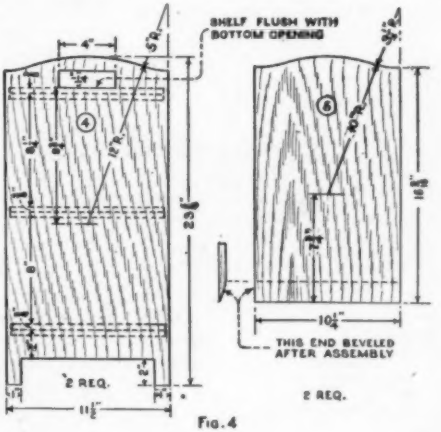


Fig. 4

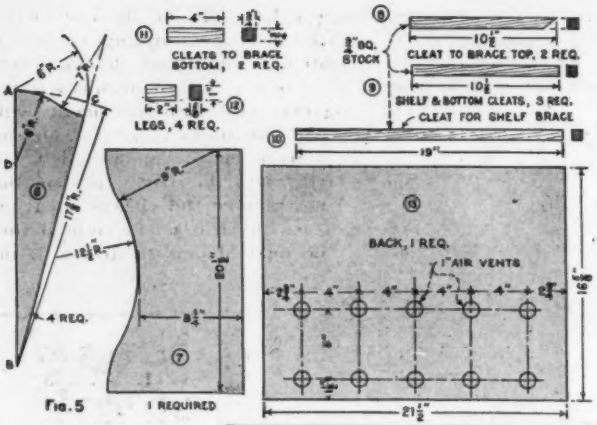
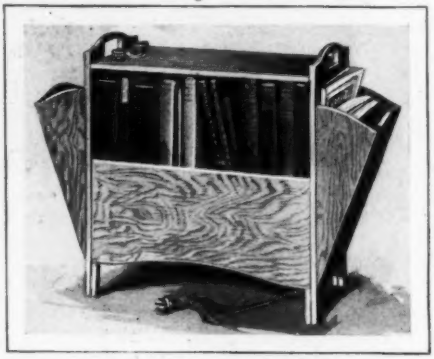


Fig. 5

with the arc just drawn from point D. The other pieces are very easy to lay out, as they are square on three sides or more. The only precaution necessary is to adjust the compasses so that the arcs will join smoothly and make a sweeping curve. A French curve is a help in dressing them up.



The table should be assembled with glue and brads. It is best to start with parts 4, Fig. 1. These should be laid flat on the bench, while cleats 8 and 9 are fastened to them in the positions indicated by the dotted lines, Fig. 4. Note that there are five instead of six cleats, one being omitted from the middle shelf to provide room for the drum dial on the radio set. Note also that the cleats at the top are beveled at the front (Fig. 5) so that they will not be visible over the books.

Spread glue on both the endpieces and the cleats, then, when the glue is tacky, press the cleats into place and clamp them. When the glue has begun to set, but before it is hard, turn the pieces over and nail the ends to the cleats with small brads. Drive them under the surface of the wood with a nailset. The holes will be filled up later.

The shelves should now be fastened in the same manner. Before allowing the glue to set, front panel 5 should be mounted. The cleats 10 and 11, which brace the front panel, may be glued in either now or later; in either case, however, the front panel should be bradded to the shelves and well clamped.

When the glue has set (which may take several days) the clamps are removed and the legs 12 put on, as shown in Fig. 6. These are simply for appearance, to make the finished leg square. The projections on the end pieces carry all of the weight. The only thing now remaining is to assemble the door and the magazine holders. These latter are simply glued and nailed together without cleats. Before fastening them to the sides, plane

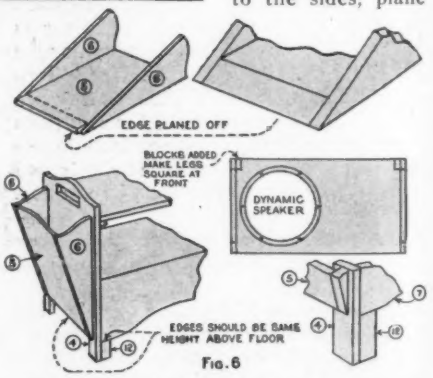


Fig. 6

off the lower edge of piece 5 as shown in Fig. 6. They are then nailed to the ends of the table. The lower planed edge should be level with the lower corner of the front panel.

The door is hung as shown in Fig. 7. If desired, the hinges can be concealed by

mounting them in the ordinary manner. Fill the holes left by the heads of the brads with putty or plastic wood, but if dark wood is used for the table, a dark filler is required.

The table is now ready to be shellacked. It may be painted, of course, if color is desired. Use either enamel or lacquer for this. If the grain of the wood is desired rather than color, white shellac is best. Four coats, rubbed down after each application, give an excellent finish. Before each of the first three coats, go over the surface with No. 2-0 sandpaper, but do not take off all the shellac with it. After the third, rub down the finish with fine pumice, then coat with very thin shellac.

To mount the radio equipment, remove the base, rectifier and transformers from the dynamic speaker, first noting the connections. The transformers and the rectifier are mounted in the middle shelf behind the books as shown in the photographs. The stripped speaker is then pushed into place from the outside of the cabinet, and fastened in place with screws. When these units have been mounted, wire them up again immediately. The underside of the table should be covered with felt to prevent the sound from reverberating in the narrow space between the floor and the table.

The radio set itself is very easy to mount, the only difficulty being in driving the condenser gang from above. This is done by mounting a drum dial on the end of the shaft with the knob pointing vertically. The escutcheon plate and the knob are removed, as only the mechanism is wanted. This, together with the radio chassis, will just slip into the allotted space beside the speaker. Mark on the middle shelf the spot exactly over the drive shaft on the dial. Then remove the chassis to avoid damaging it, and drill a 1-in. hole at this spot. The next step is to drill a ¼-in. hole exactly over the hole in the middle shelf. A ¼-in. brass shaft extends through this hole to the drum dial below, to which it is fastened by a flexible coupler. A knob on the top completes the drive. The volume control and the switch are fastened to the chassis by flexible wires, consequently can be mounted anywhere. The only things now remaining are the connecting of the loudspeaker, plugging in the speaker field in the outlet on the chassis, connecting aerial and ground, and plugging the set in on the 110-volt line.

Although the set now looks well and operates well, one thing is lacking: There is no indication of the condenser setting.

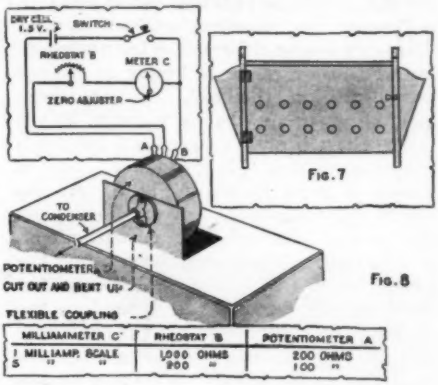
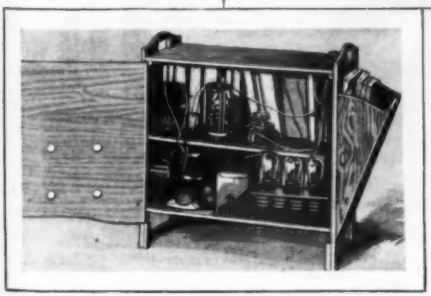


Fig. 7

Fig. 8



Top, Details of Tuning-Indicator Device; Center, Compact Six-Tube Chassis and Power Unit; Bottom, Magazine Stand with Rear Door Open, Showing Receiver Installation

We have found by experiment that it is perfectly easy to tune a set this way. Merely turn the knob until a station comes in; it is as simple as turning on a light. However, the following paragraphs describe an easy way to provide an indicator for the condenser setting.

There is a small milliammeter between the two knobs on the top of the table. This meter is used to show either dial reading or wavelength. In the former case the dial should be removed and a new one, calibrated in wavelengths, substituted. The scale can be either 0-1 or 0-5 milliamp., but the lower range is better as it puts less drain on the cell. A potentiometer, mounted on the back cover of the radio chassis and coupled to the condenser gang, controls the meter. This is shown in more detail in Fig. 8. As the circuit diagram shows, current flows from the battery through the potentiometer. As the voltage drop is uniform along the potentiometer, the voltage between the slider and the battery will depend on the position of the drum dial. It is thus only necessary to measure this voltage in order to get the dial reading. To do this we use the milliammeter C with the rheostat B in series with it.

To adjust the meter, turn the condenser rotors until they are in mid-position, and cut in all the resistance of the rheostat B. Then connect the battery. The needle on the meter should swing upscale to the right; if it does not, reverse the leads on the battery. Now rotate the condenser shaft a little. The meter reading should increase as the condenser rotors slide into the stators; if it does not, reverse the leads A and B on the potentiometer. Next turn the rotors all the way out, then loosen the setscrew on the coupling between the condensers and the potentiometer and turn the slider until the meter reads as near to zero on the scale as possible. Tighten the setscrew again. If you cannot make the meter read zero this way, turn the "zero adjuster" until it does read zero. One other adjustment remains. Turn the condenser shaft so that the rotors are entirely within the stators. This corresponds to a full-scale reading on the indicator, so adjust rheostat B until the meter reads exactly full scale. The needle on the instrument will now indicate the dial reading smoothly and accurately.

To make the battery last as long as possible, it should be turned off when not in use. The best way to do this is to substitute a double-pole single-throw switch for the one supplied with the set. One side of the switch is then used to turn the radio off and on, while the other side switches the battery.

Dr. Alger S. Riggs and the Laboratory Model of His New Receiver

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Receiver Employs New Methods

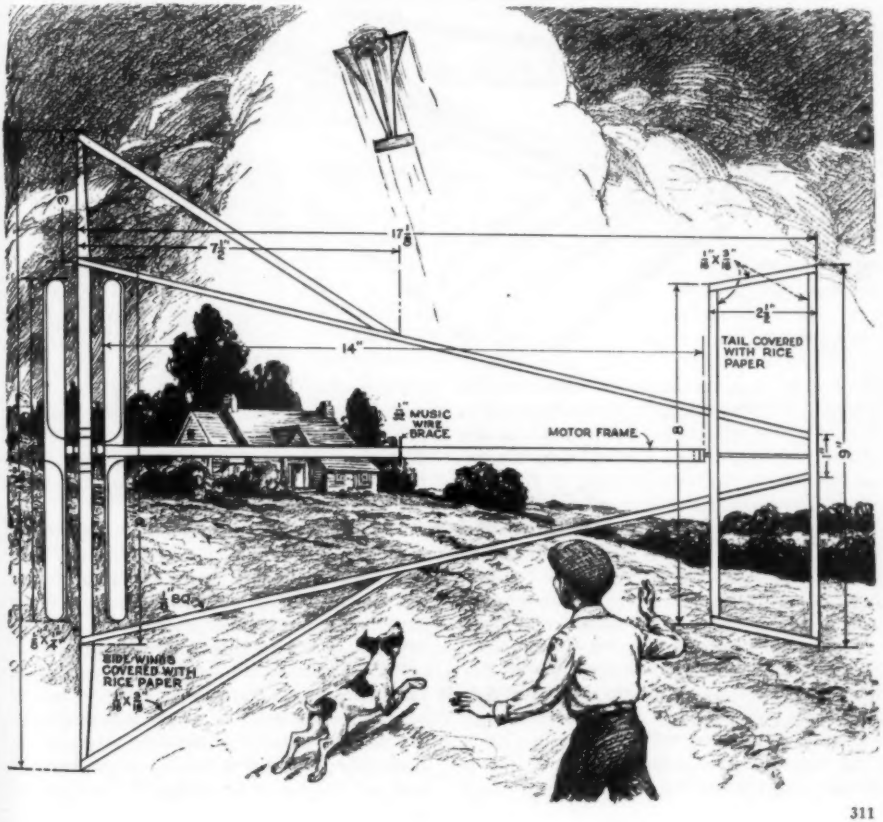
Viewed as revolutionary is the new circuit and vacuum tube invented by Dr. Alger S. Riggs, a South Carolina scientist. From the antenna binding post to the output of the amplifier everything, it is claimed, is wholly new. The circuit employs no negative grid bias, no tuned r.f., no neutralization, no gridleak and condenser, no reflexing, no C-battery and no secondary emission. The set is said not to squeal, oscillate or permit any ground noises, and the quality of reproduction is termed excellent. The new type of vacuum tube, it is said, is the heart of the invention. "Threshold detection" is the name given to the method of signal detection employed. The advantages of this method lie in the fact that extraneous ground noises may be completely eliminated. The threshold detector is said to have the sensitivity of the grid leak and condenser, with the handling power and quality of the negative C-bias power detector.

Make This Two-Propeller Helicopter

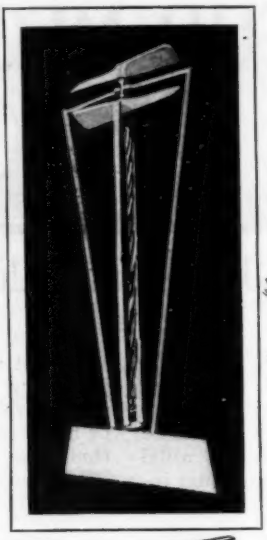
By HI SIBLEY

THIS little helicopter weighs slightly over 1 oz. and is a very able performer. The propellers rotate in opposite directions and the blades therefore should be made with less pitch than is the usual model-airplane practice for minimum interference.

At first glance the framework may appear very fragile to one experienced in model-airplane construction, but it must be borne in mind that all the motor strain comes on the central revolving frame. The outer triangular frame merely carries the small side wings and light tail.

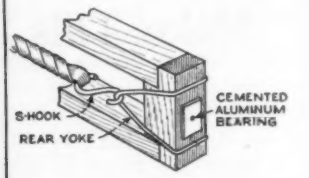


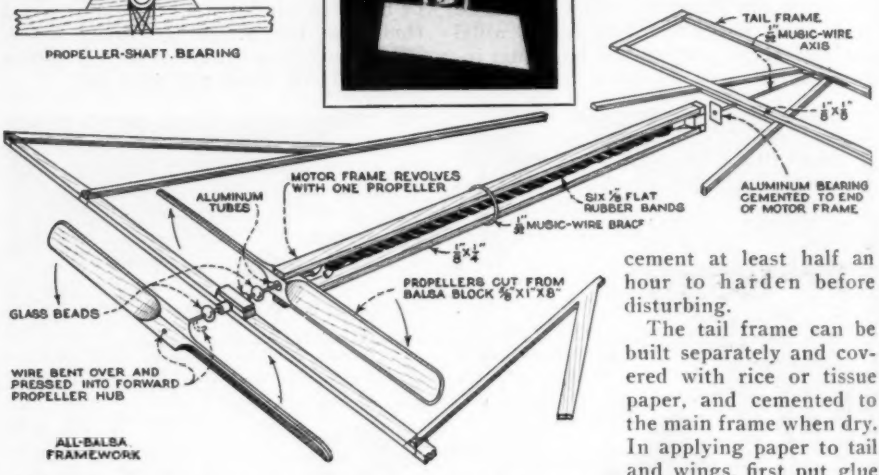
Make the propellers first, using soft balsa blocks, 8 in. long, ⅝ in. thick and 1 in. wide, a size that will work into blades of moderate pitch. The hub of one of the propellers forms the front end of the motor frame and should have a short piece of aluminum tubing inserted through it. The other propeller is fixed on the music-wire shaft. Trim the blades down with jackknife and sandpaper to about 1/16-in. thickness, and cut away as much of the hub as possible without lessening strength. The two side members of the motor frame should be of selected "hard" balsa, reinforced with a music-wire ring at the center, to prevent spreading when the rubbers are wound. The rear end of the side-pieces is secured with a ¼ by ¼-in. balsa block, cut as shown. Cement a small piece of aluminum or tin to the end to serve as a bearing for the music-wire axle.



In all cases use music wire about 1/32 in. in diameter. This is sufficiently stiff for its purposes. Note that the propeller shaft turns in the rear propeller, through the aluminum tube. The main propeller-shaft bearing on the balsa cross frame is also aluminum tubing. The writer used tubing from a tobacco pipe. There should be a glass-bead thrust bearing on each end of the main bearing.

Build up the outer frame from balsa, to the sizes indicated. Cement the joints and bind with thread. Always allow model-airplane cement at least half an hour to harden before disturbing.





The tail frame can be built separately and covered with rice or tissue paper, and cemented to the main frame when dry. In applying paper to tail and wings, first put glue on the spars with the tip of a finger. This will work it well into the grain and also prevent a superfluous amount remaining. The merest film will hold the paper, which is stretched tightly and pressed down on the glued pieces.

With all parts completed, insert the wire propeller shaft through the rear propeller-hub bearing, string on a bead, put the shaft through the main-shaft bearing (on the cross member), string on another bead, push the end through the outer propeller hub, bend it into a hook and press back into the hub over a short piece of bamboo or toothpick so it will not tear the balsa. Place a drop of cement on each side of the hub, where the wire enters, on the outer propeller.

When this has set, string on six strands of ⅛-in. flat rubber band so that they do not sag, and still are not stretched. You can wind the outer propeller by hand for 50 or 75 turns, but better results are secured with a mechanical winder. In the latter case, detach the S-hook at the rear and pull the rubbers out to about twice normal length while winding. It will be necessary to hold both propellers while doing this.

In launching, although the helicopter will rise straight up, it will go farther by sending it off at an angle of about 45°. Take care to head it for an open space or you may find yourself climbing a tree or house roof to retrieve it. The original model, shown in the photo on page 312, was built without side wings. The wings better the performance considerably.

Background for Fire Extinguisher

In order to make it easy to find fire extinguishers when needed, mount them against a background especially painted to call attention to their presence. A large circle, painted diagonally with broad black-and-white strips, forms the center of a white square as shown in the photo. The fire extinguisher is mounted in the circle, and below, on the white surface, the type of liquid used in the extinguisher is painted in heavy type.—A. Mathieu, Chicago.

Preserving Paint

To keep a small quantity of left-over paint or lacquer in good condition for future use, replace the lid securely on the can and store the can upside down. If the cover fits tightly there will be no leakage, and the paint will form its own hermetic seal, preventing it from spoiling.—Wilfred J. Lennox, Wiarton, Can.

Light for the Rumble Seat

Often it is convenient to have a light in the rumble seat. The best light for this purpose is a dashboard type with a switch incorporated in it. It is connected by running one wire to the ammeter or headlight circuit and grounding the other, as indicated by the dotted lines in the illustration.—G. A. Luers, Washington, District of Columbia.

Dashboard Lamp with Switch Incorporated Provides Light for Rumble-Seat Occupants

Wall Recess for Sillcock

Sillcocks in exposed positions may be broken off accidentally, particularly when they are located over or near a drive or platform. By making a square recess in the concrete wall at the time it is poured, and locating the sillcock inside of this recess, as shown in the photo, the trouble of breaking sillcocks will be overcome. The recess should be large enough to allow a hose to be attached and removed, and also to admit the top part of a bucket so that it can be filled.

¶ Tracking dust and ashes from the basement can be overcome to a considerable extent by providing carpet mats on the lower treads of the basement stairs.

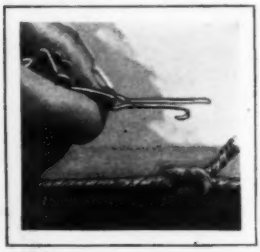
Clothespin Holder Arranged to Slide on the Line Is Always Open

Clothespin Holder Slides on Line

Every woman who has to hang the wash out will appreciate the novel clothespin holder shown in the illustration, as it is always open and can be pushed along the line as it is needed. It consists of a cloth sack hemmed at the top edge to take a No. 12 gauge galvanized-wire frame bent to an oblong shape to hold the bag open. At the ends of the bag the wire is bent upward to form a double hook by which it is hung on the line.—M. D. McFaddin, Winfield, Kans.

Sharpened Cotter Pin Is Useful Tool

For many small jobs which frequently arise when no tools of any kind are at hand, a useful device can be easily made of a ⅛ by 2-in. cotter pin, which can be kept on the key ring where it is always available. File the legs to a fairly sharp point and bend one of them to form a hook. It is always ready for one of those little jobs of digging, pulling, loosening, and many other purposes, for which the pocket knife is usually pressed into service, not infrequently to the detriment of the blades.—Frank W. Bentley, Jr., Missouri Valley, Iowa.



Substitute for Wide-Angle Lens

Wide-angle effects, the inclusion of a larger field of vision within the photo, are dependent on the use of a short-focus lens, which is one that will operate very close to the plate holder and bring objects into clear focus. When the camera enthusiast graduates from a hand camera to a view camera, he begins to feel the need of a wide-angle lens. This is not supplied with a view camera and has to be purchased separately at a cost of from $10 to $50, or more, which one cannot always afford. In this case, you will find that a portrait attachment for amateur cameras serves the purpose well as a substitute, and costs less than a dollar.—H. Rossiter Snyder, Guilford, Conn.

Sink Stoppers for Wide-Mouth Bottles

Wide-mouth bottles are generally sealed with flat cork stoppers, which have to be pried out and are often broken or punctured when they are being removed. Similar corks are usually hard to find, but rubber sink stoppers, which can be had in various sizes at any hardware store, make good substitutes. They can be used over and over again on different bottles and fit more snugly than corks. —Herman G. Cuthbert, Newark, N. J.

Mirror for Amateur Movie Kit

One of the most useful additions to an amateur's movie outfit is a mirror. With this he can reflect light on a poorly illuminated subject or into a dark corner. It can also be used as a spotlight for making portraits, or for back-lighting effects, provided the projected beam does not shine into the lens.

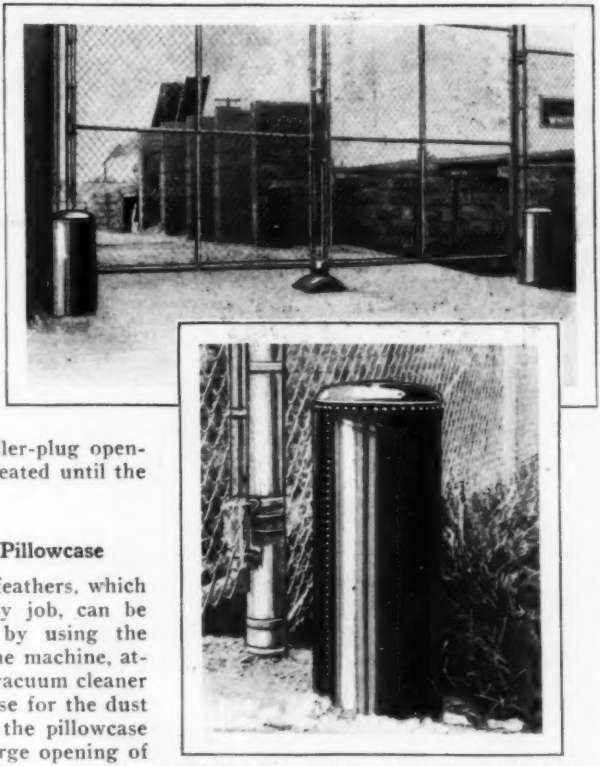
Oilcan Spout Fills Shock Absorbers

Shock absorbers on model-A Ford cars need a small quantity of glycerine added from time to time. As there is not much space above the filler opening, it is rather difficult to use a bottle or oilcan. However, the spout of an oilcan may be used satisfactorily. It is filled with glycerine and one finger is held over the large end to prevent the liquid from running out until the spout has been inserted in the filler-plug opening. This procedure is repeated until the shock absorber is filled.

Vacuum Cleaner Fills Pillowcase

Filling pillowcases with feathers, which is ordinarily quite a messy job, can be done quickly and easily by using the method indicated. Clean the machine, attach the suction hose to a vacuum cleaner and substitute the pillowcase for the dust bag. Tie the open end of the pillowcase securely around the discharge opening of the cleaner. Start the motor and lower the suction hose into the feather container. The feathers will be drawn into the casing and few of them will be spilled.

Vacuum Cleaner Fills Pillowcases with Feathers, Eliminating the Usual Work and Mess



Old Hot-Water Tanks Filled with Concrete Make Good Baffle Posts to Protect Light Gate Supports

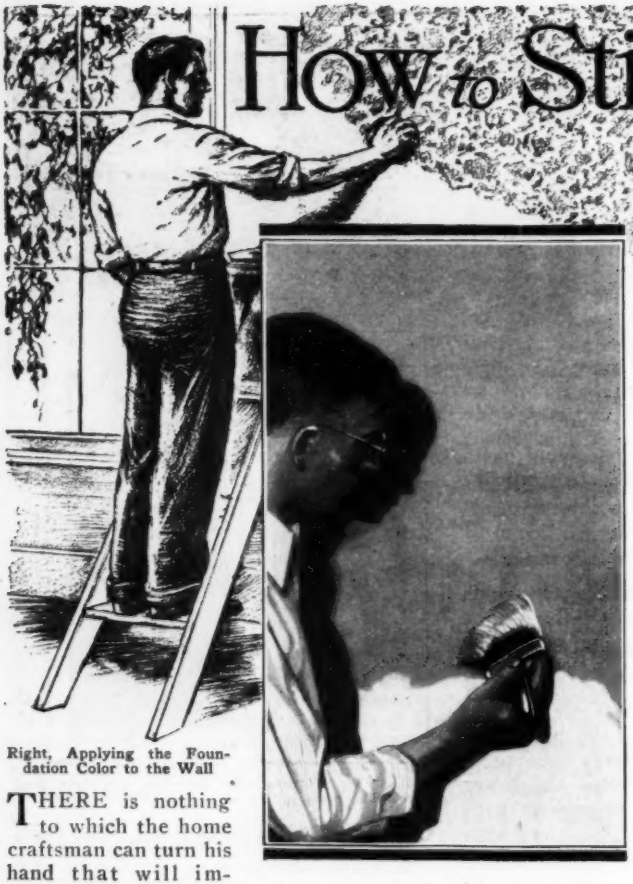
Old Water Tanks Make Good Baffle Posts

A simple and practical method of protecting light fence posts against being struck by trucks and wagons when making short turns, is shown in the photos. Two old hot-water tanks are filled with concrete and scrap iron. They are buried quite deeply in the earth and a liberal quantity of concrete is also poured around them so that they will be securely anchored. The steel shell nicely resists the nips of the wheel hubs and there is practically no denting owing to the concrete filling.

Repair for Shoe Linings

When your shoe lining is torn, trim the ragged edge and apply a piece of adhesive tape, pressing it firmly in position. Dust some powder on the tape so that the exposed surface will not be sticky.

How to Stipple



Right, Applying the Foundation Color to the Wall

THERE is nothing to which the home craftsman can turn his hand that will improve the interior of his home more, or add more to its value than the decoration of shabby walls and ceilings in richly textured paint-stippled treatments.

Painted wall decoration has been used for years in clubs, churches, theaters and residences, but, due to its high cost, has not until recently come into general use for home decoration. A word of explanation may be in order, as "painted walls" are thought of by many as fitting for kitchens, bathrooms, etc., where utility and easy cleaning, rather than beauty, are the prime requirements. However, the perfection of soft-toned, lusterless wall finishes, and the development of various decorative methods, such as stippling, mottling, glazing, scumbling, Tiffany, stenciling, etc., makes possible the decoration of living room, dining room, bedrooms and other rooms in effects of artistic distinction. The glareless wall paints of today permit the tones of the decoration to be brought out at their full value, no matter from what angle or in what light they may be viewed. They are quite as washable as painted or varnished woodwork, non-fading and very durable.

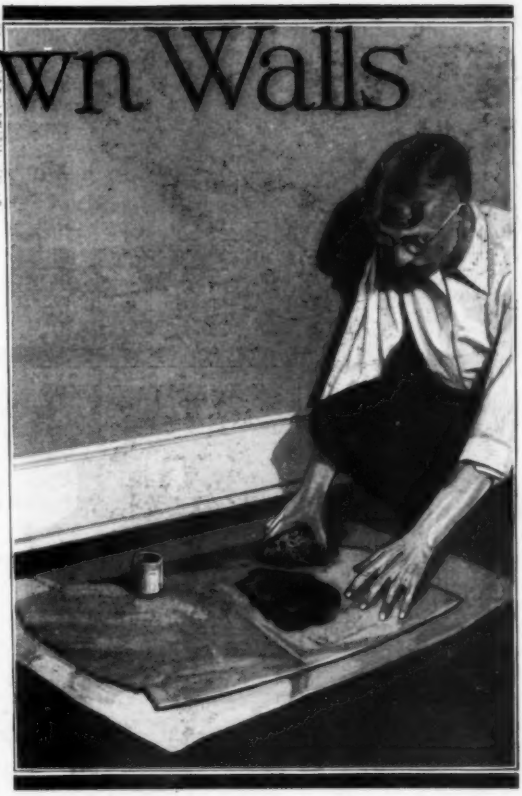
These treatments are not intricate or complicated to produce. With a little practice work on sheets of paper or wallboard, a degree of proficiency may be acquired that will insure good results.

In the use of paint for wall treatment, as with wallpaper, many prefer plain colors, without pattern, and there are also certain conditions where they are most desirable. For instance, if the furniture is unusually fine, plain walls will set it off to advantage. In some cases, also, decorative schemes are arranged for, in which color and interest are provided through draperies, furnishings and accessories, so that a pleasing effect is only possible through the use of a neutral background.

The application of wall paint in itself is a comparatively simple operation. The one important thing to keep in mind is that, where walls are of bare plaster,

Your Own Walls

by Berton Elliot



Filling the Sponge with Paint by Rubbing on a Cardboard Smeared with Paint

never before painted, the first coat should be a sizing coat, to seal the absorbent surface and keep succeeding coats from soaking in. This is sometimes accomplished by mixing wall size (sold by all paint stores) with regular flat wall paint, about equal parts of each. There are also prepared wall primers which have the size already incorporated. Three coats are ordinarily required—two of straight wall paint over the sizing or priming coat—especially with light, delicate shades, although with the darker, denser colors, two coats will often produce a satisfactory job.

Where the walls have previously been in wallpaper, the paper, of course, should be removed before starting the paint decoration, which is not a difficult job if plenty of water is used to thoroughly saturate the paper, so that it may be readily scraped off in large furrows with a wide putty knife. Any cracks or other surface imperfections should be filled, before starting to apply the priming coat, with one of the prepared patching plasters or a mixture of plaster of paris and wall paint.

After the final coat, the use of a stencil border will add a most desirable finishing touch. If it is desired to keep the walls very unobtrusive, the border may be small and light, and in subdued tones.

The first thing to fix in mind, in taking up the processes of stipple-textured wall finishing, is that all of these treatments are produced by first applying a foundation color to the wall, on which the stippled, mottled or figured effects are laid.

The foundation coating consists merely of brush coats of flat wall paint, applied in the regular way, just as if the wall was going to be left in plain color, except that two coats are ordinarily sufficient (one finishing coat over the sizing or priming coat on bare plaster walls), as it is not necessary to have as solid covering where the walls are to be stippled. The color used for the foundation coating, of course, will depend upon the effect desired.

Sponge stippling, one of the most interesting and beautiful treatments, is also one of the simplest to do. After the foundation coat has dried thoroughly, an all-over pattern is printed on the wall in one or more contrasting or harmonizing colors with a sponge. In selecting the sponge, get one that is of uniformly even

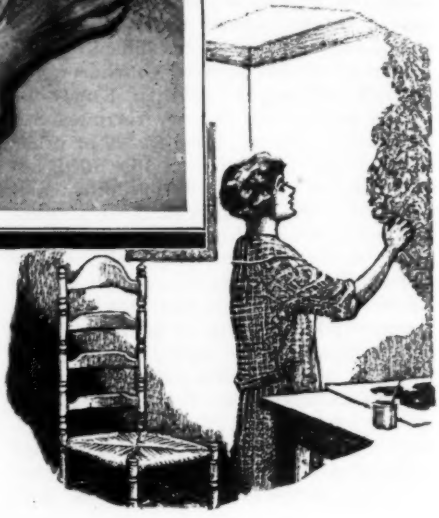
construction, without either large open spaces or solid stretches of side wall. It should be cut in two across the grain, to give a perfectly flat printing surface. If any spots are found to be a little high, they should be trimmed off with a pair of scissors, as one of the secrets of success in this work is to have an absolutely flat printing surface. This evening up can be most satisfactorily done when the sponge is wet.

We are now ready to start the stippling operation. Pour some of the stippling color onto a piece of tin, cardboard or folded wrapping paper. Regular flat wall paint of the desired color is ordinarily used for the purpose. The addition of a little varnish (about 10 per cent) makes the stipple color dry with a slight sheen, which gives a very pretty effect with the dead flat of the foundation color peeping through the glistening stipple tones.

Immediately before starting, the sponge should be soaked in water and wrung out reasonably dry. Then rub the flat side into the stipple color, until the paint has thoroughly worked into the printing surface. Tap off any excess paint on a sheet of paper. At first, do some try-out work on a large sheet of wrapping paper spread out perfectly flat on a table or on the bare floor. If these try-out prints indicate that there are any high or low places in the sponge, so that the pattern is not even, the sponge should be trimmed further with the scissors.

The method of stippling is as follows: Tap or pat the color-loaded sponge straight onto the surface you are decorating, without twisting or turning, which will imprint the pattern of the sponge in all its natural beauty onto the wall. Continue tapping over the entire surface, placing the prints

Above, Applying the First Stipple Color to the Wall

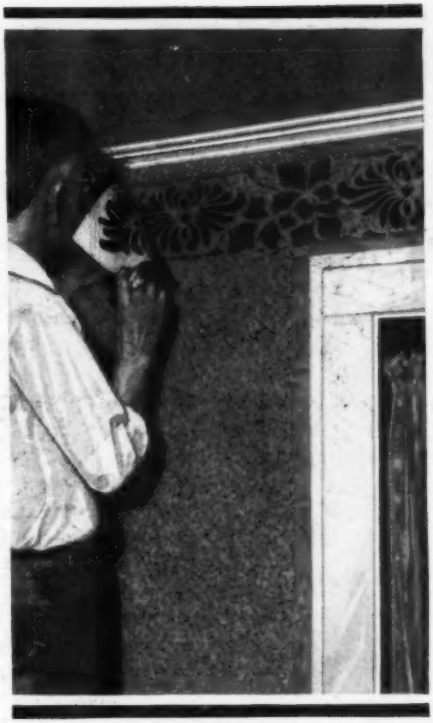


close together so there will be no intervening spaces to cause a break in the pattern, yet overlapping just as little as possible. Stagger the prints in irregular fashion, so they will not be in straight rows, otherwise the effect will be too monotonous, and will not be pleasing.

Two or more stipple colors may be applied by going all the way around the room with one color, then cleaning the sponge and (next day) going over the entire surface again with another color—and again, the following day, if desired, with a third color. While two-color and three-color effects are usually far more beautiful, they are really easier to do well than one-color stipples, for the reason that any little irregularities of workmanship in applying any of the stipple coats are rendered far less noticeable, and it is also practically impossible for any spaces of plain, unfigured background color to be left showing through in the finished effect.

Following are a few general suggestions which will help in obtaining good results: Use a small piece of sponge for getting up close to woodwork and moldings, into corners, etc. This may be a piece of the regular stippling sponge, cut from the side opposite the printing surface. A piece of tin or cardboard held against woodwork and moldings, when working up close to them, will prevent daubing them with the stippling color. Any paint that does get on woodwork or floors should be wiped off at once, before it has a chance to dry, with a cloth moistened with gasoline. In case any part of the work does not turn out satisfactorily, it may be wiped off with a cloth saturated with gasoline, although this should be very carefully done, so there will be no smeary places where the wiped-off space joins the satisfactory part of the work. After the stippling with any color has been completed, the sponge should be cleaned at once with a liberal quantity of gasoline, followed by a thorough washing in warm water and soap. This will make it as clean and soft as a new sponge.

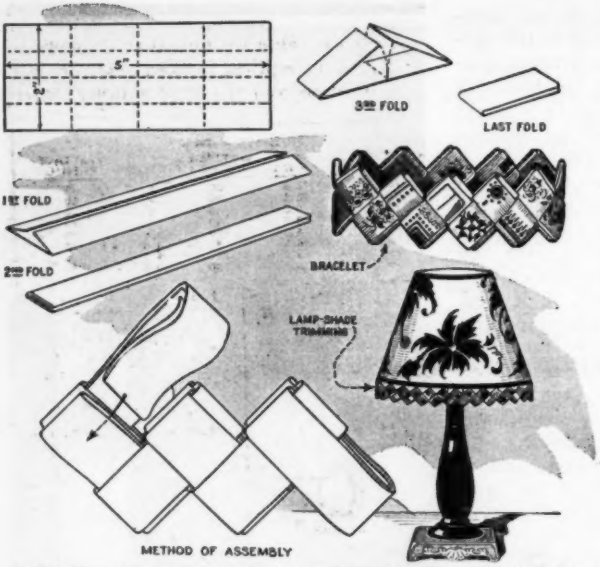
One of the secrets of success in this work is the use of harmonious colors. A few good combinations are as follows: pink foundation, stippled with a mixture of part white and part pink; dark-blue foundation, stippled with light blue; ivory foundation, stippled with buff; silver-gray foundation, with first stipple color pink, second stipple color ivory; sage-green foundation, with first stipple color buff, second stipple color ivory. Most paint stores also have samples of sponge stipple effects put out by paint manufacturers, which show just how various effects will look, together with specifications for producing them.



A Stencil Border Adds a Final Touch of Great Charm to the Stippled Wall

Outboard Motor Drives Small Lathe

The owner of a small outboard motor will be interested to know that it is capable of furnishing sufficient power to run a small lathe or circular saw. Transmission is provided for by a belt slipped over the flywheel or from a pulley on the propeller shaft. The motor can be conveniently held by clamping it to a board nailed to the bench or in a vise.—J. Lawrence Evans, Jr., Bauner House, N. Y.



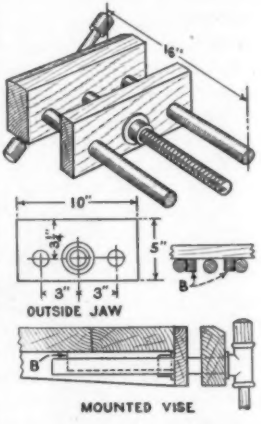
Colored Magazine Advertisements Are Used to Make Heavy Braid for Lamp Trimmings and Other Purposes

Braided Paper Trimming Made from Colored Ads

Colored advertisements in magazines furnish excellent material for making braided trimmings which may be used for many purposes. Cut strips 5 in. long and 2 in. wide. Fold them lengthwise, each side toward the center, until the edges meet; then fold the strip over lengthwise in the center, and lastly fold the ends toward the center as shown in the drawing. After two strips have been prepared in this way, the tips of one may be laced into the folded opening of the other. Vary the colors of the paper and continue placing one strip into the preceding one until the trimming is as long as desired. For parchment and paper lampshades, this trimming may serve as a binding for the top and bottom of the shade and may be treated with a coat of shellac the same as the shade. The joining of the strands is easy. The trimming may also be used by children for suspenders, tying the ends to the belts and crossing the strands at the back. Girls can use it for bracelets, necklaces and for trimming play hats. It will also do as a banding for work baskets, etc.—Sandra LaPlante, Washington, Ill.

A Handy Bench Vise for Rough Work

Where rapid action is not needed or the worker desires an odd vise for rough work, it is possible to make one from an ordinary iron vise screw as shown in the illustration. The usual method of construction is to allow the outer jaw to extend to the floor but this arrangement is not always convenient. Cut the outer jaw from a piece of 2 by 6-in. oak, or, better still, glue two pieces of 1-in. stock together, 5 in. wide and 10 in. long. Strengthen this piece further with screws and drill a 2¼-in. recess with an expansion bit, 5 in. from the end, 3¼ in. from the top and about ½ in. deep, to take the collar on the screw. With the same center drill a hole for the screw. If the screw is 1 in. in diameter the hole should be 1⅛ in. in order to prevent binding. Three inches from this hole, on either side and on the same center line, drill a hole 1 in. in diameter, making sure that both are as true as possible. Plane the inner surface of the jaw carefully and sand it down so that it will not mar the work when tightened. Get a stout hickory or maple handle, 1 in. in diameter throughout its length, and cut from it two 16-in. pieces. Smooth with sandpaper and drive them into the outer holes in glue. Drill a ¼-in. hole up from the lower edge of the jaw and key the rods



with dowels. Make the inner jaw of hardwood and fasten it to the bench with screws. Drill three corresponding holes to take the rods and screw, each 1⅛ in. in diameter. Fasten the nut on the back of the inner jaw and after starting the screw, bring the jaws tightly together. Screw a piece of stock to the underside of the bench top just over the rods. This piece should be of such thickness that the rods will bear against it. Between the rod and the screw fasten a piece of 1-in. stock, making sure that the jaws are parallel before tightening them in place. Use two of these pieces and have them bear hard against each rod, as at B in the detail. This will hold the jaws parallel when tightened. Lastly bevel a piece of 2-in. stock and tighten it solidly to the bench top and the inner jaw of the vise. This makes a sound, serviceable vise that can be used for the roughest work.

Preventing Drain Cock from Freezing

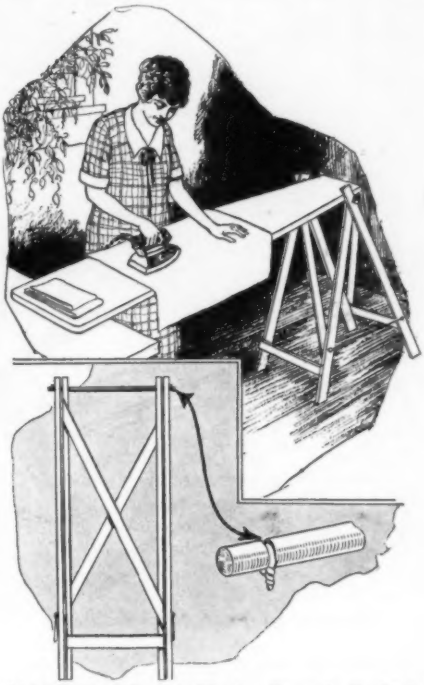
During the winter we are troubled with the sink-drain trap freezing and bursting. Instead of removing the whole trap in order to empty it, I purchased a small cock of the kind used to drain Ford radiators. With this, the trap was emptied easily.—J. A. Tandy, Ghent, Ky.

Wooden Tweezers Easily Made

On repair jobs which require the handling of small parts, a pair of tweezers is a great convenience. If not at hand, it is easy to improvise a pair from two matches and a rubber band as shown in the photo. Break a short piece off the end of one match to use as a pivot or fulcrum; this is slipped between the matches, and the rubber band is then wound around the assembly, so that it forces the ends together. the ends, of course, should be whittled flat where they make contact in order to insure a tight grip.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Folding Horse for Ironing Board

In the absence of a built-in or collapsible ironing board, it is quite customary to



Lightweight Collapsible Wooden Horse Is Useful for Supporting the Ironing Board

place one end of it on the table and the other on the back of a chair. This method is not always satisfactory, as the chair may slip, and it is much better to provide a light folding horse to support the board. Make the legs of ¾-in. square stock, each braced with one crosspiece and one diagonal. They hinge together on a 5/16-in. iron rod, such as a piece of baby-carriage axle, which is strong enough to hold the ironing board without bending. The ends of the rod are grooved as indicated, which can be done with a hacksaw. Heavy galvanized wire is wrapped in each groove so that the legs won't slip off.

¶If a new cotton clothesline is boiled in water for a few minutes and allowed to dry before being used again, it will be thoroughly shrunk.

Illuminated Road Map, with Extension Cord Attached to the Car's Wiring System, Is an Improvement That Will Greatly Help Motorists

Illuminated Road-Map Holder

Reading a road map at night with only the dashlight to provide illumination is rather difficult. If you do considerable driving at night it is a good idea to make an illuminated map holder as shown in the drawing. It consists of a ½-in. board, about 8 in. wide and 10 in. long, having a tin hood tacked to the upper long edge, to serve as a shade and reflector for two small dashlight lamps. A toggle switch is mounted on the hood and a flexible cord fitted with two spring clips is provided for connection to the wiring system of the car, one being attached to the ammeter terminal and the other grounded. The map is held in place with rubber bands. On some cars it is possible to hang the holder on the crossrail above the instrument board by means of two L-hooks.—C. E. Packer, Chicago, Ill.

¶Pure turpentine, dropped on a piece of white paper and exposed to the air, will leave no trace of foreign matter.

Easy Method of Making Ice

The farm icehouse can be filled in the winter without the trouble of taking the ice from a pond or lake and sawing it into cakes. Fill a number of paper boxes, about 1 by 2 by 2 ft. in dimensions, with clean water at night when the weather is cold enough to freeze it in a few hours. The resulting cakes are easy to handle and store. This method has been used successfully by a South Dakota farmer.—Ferdinand J. Wiener, Sauk Center, Minn.

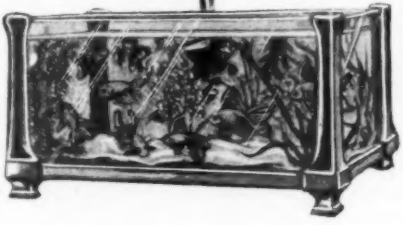
Old Lawnmower Makes Good Truck

An old lawnmower can readily be converted into a serviceable truck for carrying barrels, boxes, etc., around the yard. First remove the wheels and small gears inside of them. Loosen the frame in order to take out the rotary cutters and the wooden roller. The stationary blade is retained to form a rest for the load. A hook, made of heavy galvanized-iron wire, is attached to the handle with a woodscrew, to hold the upper end of a barrel against the handle.

Old Lawnmower Converted into a Small Truck for Carrying Barrels

FISH are among the few pets that make no noise, produce no odor and are cleanly in their habits. For that reason, aquariums are becoming popular in homes, schools and even business offices. But many keepers of aquatic pets do not meet with success simply because they are not familiar with the habits of fishes.

If you want to keep goldfish or tropical fish, obtain an aquarium built of flat glass sides set in a metal frame, rather than a spherical bowl. A bowl is all right, provided it is large enough and that too many fish are not kept in it. But such bowls usually are sadly overcrowded, and oxygen-producing plants cannot be placed in them as well as in aquariums; they are then mere prisons to the fish. Besides, the curved sides distort the appearance of fish and plants. The tank with rectangular sides should be of such dimensions that as much water surface as possible is provided. This permits air, essential for the breathing of the fish, to penetrate the water. The depth of the water should be from 8 to 12 in.



There should be, roughly, 1 gal. of water or 20 sq. in. of water surface for every inch of fish, according to Dr. J. T. Charleson, chemist for William Tricker, Inc., the largest raiser of fancy fish in the world. Thus, if you have an aquarium with a surface of 400 sq. in., you can keep twenty 1-in. fish, or five 4-in., and so on, in it.

An aquarium should be virtually a cubical section of a lake or pond. Therefore it should have plants, scavengers and sand, as well as fish. The sand preferably should be of the white or silicon variety, well washed; it is placed over the bottom to an average depth of from 1 to 2 in., and heaped up more at the back than in front. Aquatic plants are set in it, near the back and ends of the tank so that a clear view of the fishes is provided in front.

The plants have a purpose other than being ornamental. They grow and in so doing, absorb some of the waste matter from the fishes. But, more important, they liberate oxygen, which is necessary to fish and also keeps the water fresh. There are five or six common water plants that give satisfaction in the home aquarium. Their names may mean little to you, but your aquarium-supply man will recognize them. Here they are: vallisneria, having long, grasslike leaves; saggitaria, similar to vallisneria, but with short, rather stubby

Illustrations, Courtesy William Tricker, Inc.

salamanders and tadpoles, which remove excess food; weather fish, which cultivate the sand around the plants, and clams, which form natural filters for the water. So if you dislike changing water, provide your aquarium with a sufficiently large army of cleaners.

You have two general choices as to the fish themselves. You can have a collection of plain and fancy goldfish, or you can go in for the smaller, but perhaps more interesting, tropicals. But don't try to raise both kinds in the same tank, for their habits are different, and the larger goldfish sometimes become cannibals long enough to eat the others.

The names of popular gold-

leaves; anacharis, a beautiful plant with short leaves radiating from a stem; Ludwigia, a highly ornamental plant with broad leaves; greenhouse spatterdock, a plant with large, broad, light-green leaves, which is better suited for the large tank; water poppy, the only practical flowering aquarium plant, and floating elodea, a good cover for young tropical fishes.

With proper plants, balanced aquariums have been kept in condition for two years, without change of water. Most of the plants mentioned have roots, and must be firmly fastened in the sand. Dead parts should be pinched off and removed from the water. If some of your plants mysteriously disappear, it is simply because the fish have eaten them.

There are certain creatures that you can put into your aquarium which will function as an efficient "street-cleaning department." Snails are the most common and suitable of these scavengers. Two to a gallon of water are about right. There are four preferable kinds of snails, Doctor Charleson points out. The largest is the Japanese snail which bears its young ones alive. Then there are Copenhagen reds, black ramshorns, and trumpet snails. The snails clean the glass and devour decaying vegetation. Among other scavengers are

fishes frequently are descriptive. There are, for example, the Japanese calico fishes, calico fringetails, Japanese fringetails, Chinese telescopes with their protruding eyes, comet tails, lionheads, and the like.

Most people kill their goldfish by kindness, authorities claim. They feed them too much. The familiar wafer food is losing popularity, and is giving way to preparations containing necessary vitamines, proteins and other substances. A live fly or other insect now and then is excellent. Feeding should take place every day for tropical fish and every other day for goldfish, but only as much food as will be consumed in 5 minutes should be given adult goldfish. With small, young goldfish, as much as can be eaten in 15 minutes is permissible. A large fish will eat half its own weight in that time. If you miss a few days, the fish will not suffer much. Remove all uneaten food, as it contaminates the water. A feeding ring, consisting of a disk or square of tubing that floats on the water, will keep floating food from spreading.

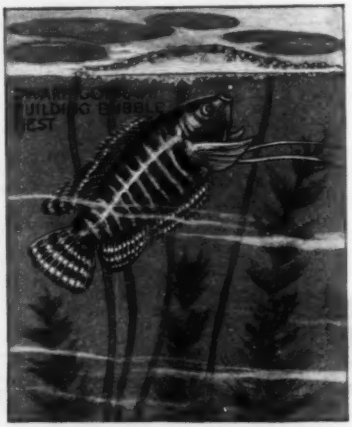
Goldfish can stand fairly low temperatures, but be careful not to subject them to sudden changes. In renewing the aquarium water, let the fresh supply stand in the room long enough to become of the same temperature as that in the tank. Otherwise, a sudden bath in cold water may cause your fish to become sick with one of several possible diseases. But with a balanced aquarium, you need not change water often—not more than once in six months or a year. From time to time, waste matter that collects on the bottom should be siphoned out. Then fresh water, which has been allowed to stand for a few hours, must be added to compensate for this and for evaporation.

Tropical fishes are bringing new pleasures to thousands of aquarium owners. There are some 120 different varieties available. Some of these are importations from tropical waters, while others are the results of cross-breeding. But regardless of their source, the markings and habits of tropicals are always interesting.

These fish are, on the average, much smaller than goldfish, but are more hardy. They do not require as much oxygen, and therefore more of them can be kept in a tank of given size. They are fed every day, and you need not be so careful about giving them too much. The only disastrous result of providing too much food for tropicals is that it sours and fouls the water, often

killing the fish. As much as will be eaten in 15 minutes is the rule.

The only precaution to take with tropicals is to keep the temperature above 70°, but not over 82° F., although there are a few varieties that will exist in water as low as 45°. If your aquarium is in a place where it will become too cold overnight, a small electric bulb, partly immersed in the water, or a special electric heater obtainable for the purpose, can be used.



A cover of some kind is necessary for the tropical aquarium, for these little fish are so lively that they will jump out of the water. This might be all right for the Chinese walking fish, which can travel overland for half a mile, provided the land is damp; but it means "taps" for the others. Even goldfish sometimes become acrobatic and require a cover. A sheet of glass is all right, if it does not completely shut out the air. A screen of some noncorroding material, such as aluminum, is better.

Varieties of tropical fish are too numerous to be listed, but one of the most striking is the angel fish which, measured from fin tip to fin tip, is wider than it is long. The zebra fish is little but active. Many of the tropicals bear their young alive. Others, like the dwarf gourami, or the rainbow-colored Betta Trickeri, build bubble nests in which the eggs are laid. Some of the parents guard their young or eggs closely.

There are a few other hardy fishes that are neither tropicals nor goldfishes. The nest-building stickleback, which constructs a nest of twigs and plants, is one. The chætodon or "poor man's angel fish" is like the angel but minus the wings. It lives with goldfishes. So does the black bullhead, which is a jet-black fish with long, whiskerlike feelers. If you go in for breeding fish, there are many more interesting things that you should learn, and a visit to a large fish hatchery is advisable, as being both educational and interesting.

Sometimes, in a large aquarium, you will have trouble with a small leak, especially after a complete changing of water. If very small, the leak frequently will heal itself, or a little mud introduced into the water will, upon settling, plug the hole. But it is perhaps best to locate the hole, and then drain the water and apply aquarium cement. This is a preparation that you can purchase, and which adheres to the glass but remains somewhat soft and elastic so that it will not crack.

It is unwise to place an aquarium in the direct sunlight, without shading with paper or cloth. For one thing, the formation of a green scum of algæ on the glass will result. But there should be enough light for the plants. A north window is suitable. At night, the aquarium can be made a thing of surprising beauty by arranging a small electric lamp behind it, so that the light passes through the water, or the light can be placed at one end so a side illumination is provided. A 10 or 15-watt bulb, colored if you like, is about right.

Whistles for Toy Steam Engines

Many whistles on toy steam engines do not work, owing to the fact that they are of the air-column type, and the frequency necessary for operating them is too high to maintain in the case of a toy steam engine. A good substitute whistle can often be made from a blow note of an old "harmonica" or mouth organ. With a hacksaw, cut out a rectangular piece containing the blow note, from the brass plate on which it is mounted. Make a tin or sheet-metal compartment about the same size as the hole in the wooden base of the harmonica, and fasten to this the blow-note plate. Fasten the whistle thus made above a valve. Be sure that you do not get a draw note. Sometimes the high-pitch reeds will work better on a small

boiler than the low-pitch reeds will do. If a tire valve has the flange cut off to just a little ring, and is mounted on the boiler, water can be forced into the latter with a bicycle pump when the supply becomes low, and the engine can be run continuously. The rubber on the valve wears out fast in this service. It is possible to use greased-cord packing instead of the rubber, but valves using this kind of packing are hard to keep tight.

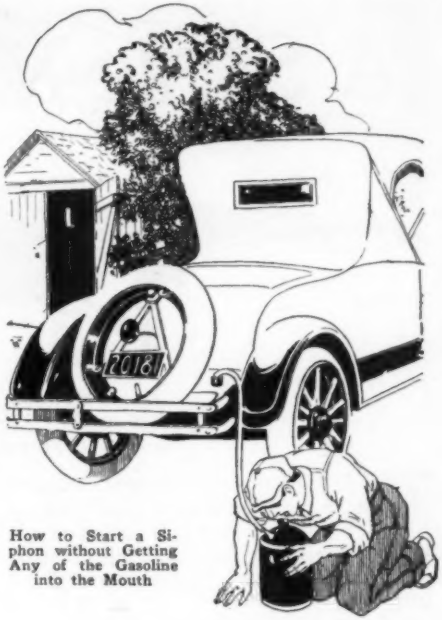
Fireproofing Cloth

Cloth holders used around stoves, fire screens and the like, can be made fireproof by the following method: Mix equal quantities of alum, borax and vitriol (copper sulphate). Dissolve the mixture in boiling water or a thin size made by melting 1 oz. of glue or gum arabic in 1 gal. of water. Use no more water than necessary to dissolve the mixture thoroughly. Immerse the cloth in this preparation, and, when dry, it will be entirely fireproof.—William P. Mack, Chicago.

Old Carpet Useful on Boat Dock

Last year one of our neighbor's boys lost his life from blood poisoning caused by a sliver which entered his foot while playing on our boat dock. To prevent any similar occurrence, we have laid an old carpet runner on the dock. Besides preventing the danger of slivers, the carpet gives bathers a firm foothold when the dock is wet.—C. A. Gunn, Minneapolis, Minn.

Carpet Runner on Boat Dock Protects Bathers against Wood Slivers



How to Start a Siphon without Getting Any of the Gasoline into the Mouth

Better Method of Siphoning Gasoline

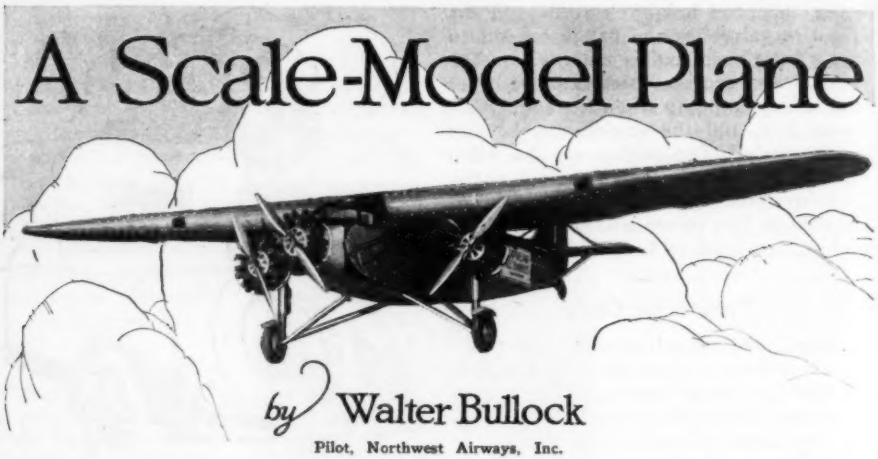
When starting a siphon to obtain a small quantity of gasoline for an emergency, it is annoying to get some of the liquid into the mouth. To avoid this proceed as follows: Attach the hose to the spout of a gasoline can as indicated. It should fit tight in order to prevent the escape of air. Then remove the cap and suck the air out of the can at the top. The gasoline will then start flowing.—A. C. Wilson, Columbia Cross Roads, Pa.

Eraser for Cleaning Bone and Ivory

Small curios and oriental carvings in ivory and bone are often rather difficult to clean. An ordinary typewriter eraser, however, will do the work effectively. It should be trimmed to suitable shape with a knife so that it will reach inside of the small spaces. Fragments of the eraser that may stick to the article are removed with a soft brush.—Douglas Leechman, Ottawa, Can.

¶Photographic work in the dark room is greatly improved by the use of distilled water in the preparation of solutions.

A Scale-Model Plane



by Walter Bullock

Pilot, Northwest Airways, Inc.

THE DOOR to the passenger compartment is cut from a piece of galvanized iron and covered with corrugated metal, leaving 1/16 in. of the plain iron showing all around the edge. This narrow band later will be painted.

An exact scale template for the galvanized-iron base is shown in Fig. 23. Cut the door and file down the window opening to exact size. Lay the door on a piece of the corrugated metal, with the corrugations parallel to the top and bottom of the window, and mark around the edges. Cut out the corrugated covering, and then, with the shears, pare off 1/16 in. all around the edge, giving you a corrugated cover of the right size. Sweat the cover to the door, being careful to keep the margin even all around. Cut out the window, using the opening in the iron as a guide. File the edges smooth. Any little inequalities in the margin around the corrugated cover can be smoothed out by running a file around the edge. The door goes on the right side of the fuselage, looking forward from the tail, and fits over the rear cabin window, as shown in the picture of the completed model on page 331. Spot it in place with two or three drops of solder, taking care not to move the covering while the solder is soft.

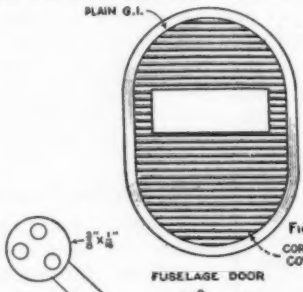


Fig. 23

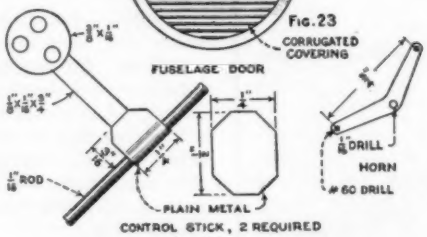


Fig. 24

The control sticks in the pilot compartment and the pilots' seats also are fitted before the wing is added. The Ford has dual controls of the Deperdussin wheel type. The wheels and columns are cut from a piece of three-ply veneer, 1/16 in. thick, to the dimensions in Fig. 24. Glue the wheels to the sticks, the latter reaching to the center of the wheel. Next cut two pieces of plain nickeled brass, 3/8 by 1/2 in., clip off the corners, bend them around a length of 1/16-in. copper-coated iron wire, 3 or 4 in. long, insert the sticks, bend the brass over the "T" at the base of the stick and solder.

The seats are plain bucket type, made with a solid wood block for seat and base, and a piece of plain nickeled brass bent to form the back. The details and dimensions are

Is Easy To Build

clearly shown in Fig. 25, and no other instructions are necessary. A metal seat may be soldered in to cover the top of the block. The two seats are glued to the floor, leaving an aisle between them. Next drill through the sides of the pilot compartment, ⅛ in. above the floor and about halfway between the rear of the nose block and the front of the seats, using a 1/16-in. drill. Remove the controls from the wire, insert the latter through one side of the fuselage, string the control sticks on it, and push the rod on out through the other side. Center the wheels in front of the two seats and attach them to the wire with a drop of solder. Cut two elevator-control horns from galvanized iron, as shown in Fig. 24. Holding the wheels upright, solder the horns to either end of the rod at the angle shown in the photograph of the plane's nose, and cut off the excess rod, filing the ends down smooth with the horns.

Cabin seats are optional, but in a model of this size so little of them can be seen —only the tips of the backs—by even the closest inspection, that it is hardly worth while to put them in. If you do want cabin seats, however, only the backs need be made. The Ford of which this is a model is the 14-passenger ship, with 13 fixed chairs and one folding seat beside the door, in the rear corner of the cabin. An easy way of making chairs is to cut a strip of thin board the width and length of the cabin, make 7 equally spaced saw cuts across it, and in them stick 13 small

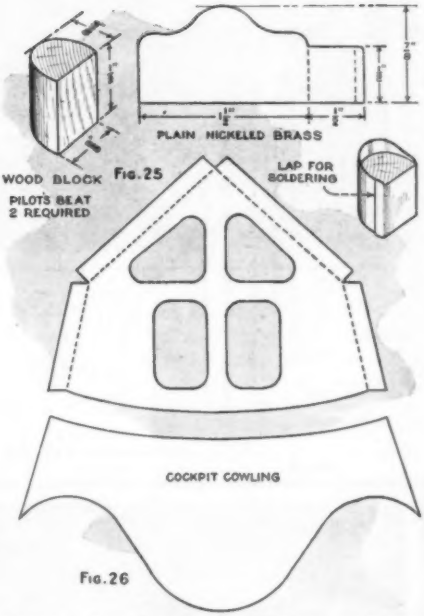
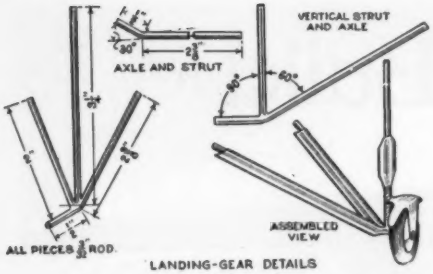


Fig. 25

Fig. 26

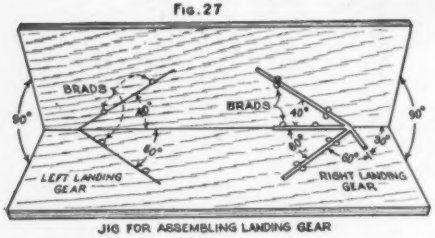
pieces taken from a berry box, painting the upper ends with aluminum paint. The small part that can be seen through the cabin windows is very effective.

You are ready now to attach the wing. Mark the exact center of the wing so that it can be lined up with the projecting tip on top of the fuselage. Starting near one tip, push the wing through the fuselage opening. If it sticks before reaching the center mark the places where the



LANDING-GEAR DETAILS

Fig. 27



JIG FOR ASSEMBLING LANDING GEAR

Fig. 28

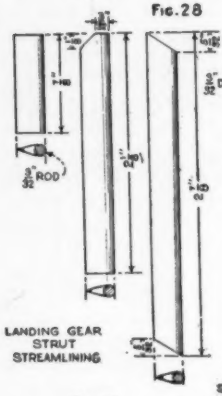


Fig. 29

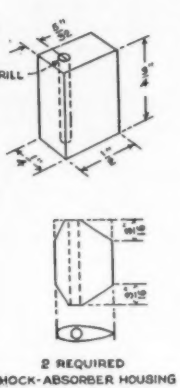
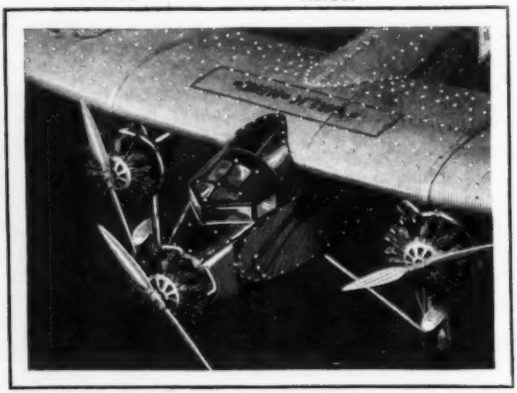


Fig. 30



metal on the fuselage is binding, remove the wing and file away the excess metal around the opening, and wood, too, if it is in the way. Continue until you can get the wing into its exact position. Using a T-square on the straight front edge of the center wing section, with the corrugations on top of the fuselage as a fore-and-aft line, adjust the wing to right angles with the fuselage, then secure it by removing a couple of the brads in the top of the fuselage and driving longer ones down through the wing.

Solder the wing to the metal covering of the fuselage, smooth down the solder joint, and then cut strips of plain nickeled metal, 3/16 in. wide, cup them slightly, and sweat them down over the joint, working all the way around, both on top of the wing and along the fuselage underneath.

The cowling over the pilots' cockpit comes next, and then you will be ready to start on landing gear and motors. The cowling is cut from galvanized iron, in two pieces, one of which contains four windows, to give the pilot a view above him. The exact sizes are shown in the two full-size templates in Fig. 26. The other piece projects up over the wing and fits down around its leading edge. Cut out the two, cut the windows with a cold chisel, file the edges straight and the corners round, and you are ready to bend them. As every model differs a trifle in size, it might be well to cut the cowling slightly oversize and trim it down to fit as you bend it into shape.

The piece containing the four windows has four soldering flanges which are bent down first. Then cup it to the shape shown in the photographs of the fuselage nose, fitting the soldering flanges on the outside of the windscreen which is already in place. The celluloid windows can be cut from an old photographic film, after soaking off the emulsion in hot water. Cut the film to the same size and shape as the cowling, place it underneath the metal, and it will naturally cup upward to a good fit. When you get an accurate fit, solder the two together. The other piece is bent and fitted in

the same way, taking care to get an accurate joint around the wing before soldering. Smooth the solder joint down with a small round file. All this cowling is later to be painted.

Now comes the landing

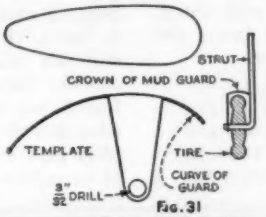
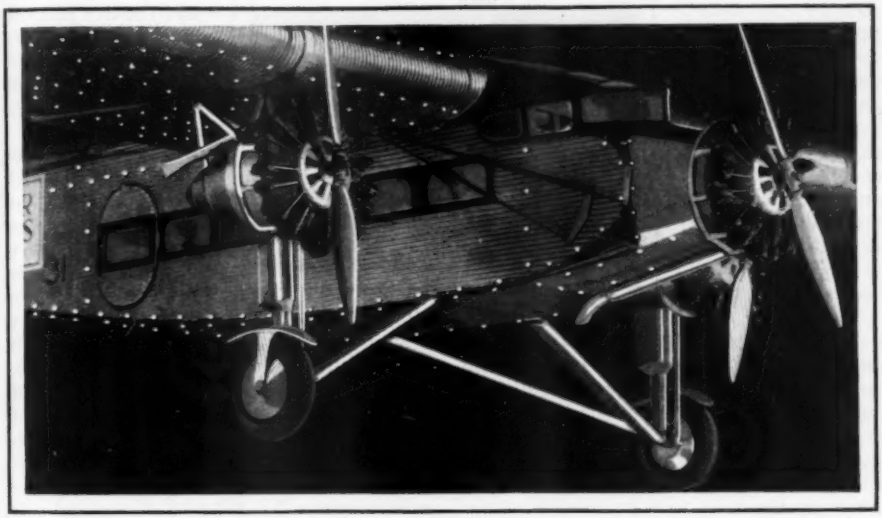


Fig. 31

meet, fastening it with brads on both sides; place the other two rods in position, the longest on the 40° line and the shortest on the 60° mark, and secure them with brads on the side away from the line. When all three are in place, with the bent axle lying flat against the board, run plenty of solder into the angle to hold them firmly.



gear. It looks more difficult than it really is. Copper-coated iron wire, $\frac{3}{32}$ in. in diameter, is used for the struts and axles. Three pieces are required for each side. One is $2\frac{7}{8}$ in. long, one 2 in., and the third $3\frac{1}{4}$ in. All of the details of the landing gear are shown in Figs. 27 to 30. Start with the $2\frac{7}{8}$-in. length and bend $\frac{1}{2}$ in. at a 30° angle to form the axle, as shown.

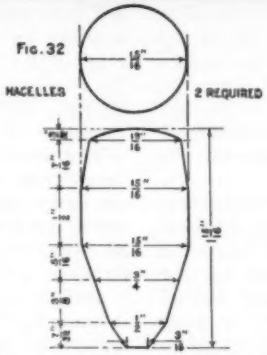


Fig. 32

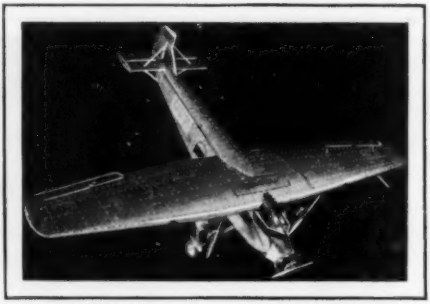
To assemble the three pieces and solder them together with accurate angles, you will need a jig, which can be made from two scraps of board nailed together at right angles. The jig is shown in Fig. 28. After nailing the boards together, lay out the two angles, one of 40 and the other of 60°, as shown. Drive two brads into each line, lay the bent rod in place with the bend at the point where the two angles

To make the other side of the landing gear, a second jig must be laid out, with the angles pointed in the opposite direction, as shown in the jig sketch. This is necessary as one left and one right-hand gear are required, with the long strut in each pointing to the rear. Smooth away the excess solder with a file, taking care not to cut away enough to weaken the joint and get the struts out of alinement.

The streamlining of the struts is made from plain nickeled brass, and the streamlining of the shock absorber, on the short vertical strut, which later will be attached to the bottom of the wing motor nacelle,

is cut from wood and painted with aluminum paint, or, as described later, the wood itself may be nickelplated.

For the metal streamlining, cut strips of plain metal, ½ in. wide. The lengths and other details of the three are shown in Fig. 29. Bend them down the center, over the edge of a board, then lay a length of the 3/32-in. rod in the bend, press the edges together and solder them. Cut the lower end of the 2⅛-in. piece as shown, and both ends of the longest one. Slip them onto the struts, and pare away the solder until they fit well down near the axle bend.



The shock-absorber housing, which goes on the vertical strut on top of the metal streamlining, can be cut from any soft wood, pine or poplar both being excellent. Cut two pieces to the dimensions shown in Fig. 30 and drill a 3/32-in. hole through each. With a knife, round off the front edge, and cut away the sides to a knife-edge at the rear, carrying out the same streamline form as in the metal parts. Bevel the corners, round off the front edge of the bevel, pare the sides down and carry the knife-edge of the back down to the drill hole. Smooth down the pieces with sandpaper and slip them into place on the short struts.

The metal streamlining on these struts has been cut somewhat longer than required. The over-all length from the bottom of the axle to the top of the wooden shock-absorber housing should be 1 11/16 in. Measure the length on your model, and cut off enough of the metal to bring it down to the required over-all length.

The long strut is the rear one. Be sure the streamline parts all point with the thin edge to the rear, and then solder them in position at the axle joint, taking care not to soften the previous solder enough to change the angle of the struts. Remove excess solder with knife and file.

Landing-gear wheels are 5/8 in. in diameter, 3/8 in. thick, and are grooved to take a 3/32-in. rubber tire. Wheels and tires can be obtained ready-made for the model; suitable wheels and tires may be found on dime-store toys, or wooden wheels and tires may be turned, and the tires painted black. A tail wheel, 9/16 by ⅛ in., cast complete with tire, may be obtained ready-made and the tire painted black, or a suitable wheel can be found at the dime store on some cheap toy automobile.

The landing-gear wheels are covered by mudguards, cut from galvanized iron. Exact-size templates for the two parts are shown in Fig. 31. The fender is given a crown effect by bending it over a small dowel, a nailset or even a round pencil, then curved fore and aft, the forward half to about the same radius as the tire, and the tail left almost straight. The side is soldered on at right angles, after drilling a 3/32-in. hole, as shown, for the axle. Slip the mudguard on the end of the axle and solder it to the strut, with the side support vertical, in the same plane as the strut. Next solder the guard to the axle end, and file the axle down almost flush, the filing giving a slight burr to help hold the guard in place.

You are ready now for the nacelles, or "eggs," on which the two wing motors are mounted. They are turned from wood, the dimensions being shown in Fig. 32. Nacelles, ready-turned to size, can be obtained with other kit parts, if no lathe is available to make them. After the plane is completed, the nacelles and other motor and landing-gear parts may be painted with aluminum paint, or they can be nickelplated, as suggested before.

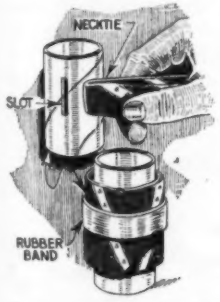
If you decide to have the nacelles and shock absorbers plated, the wood should be so treated before assembling, and, after the motors are completed, they can be returned to the plater for another coat of nickel, to cover the exhaust pipes and mounting struts.

(To Be Concluded Next Month)

Radiator Steam Softens Transmission Oil

Ordinarily the water in an automobile radiator should not be allowed to boil, but there are times when steam from the radiator can be used to advantage. As cold weather sets in, many motorists realize that the old thick grease in the transmission and differential should be cleaned out thoroughly and thinner grease substituted. Many service stations, especially those in the northern states, use steam to soften the old oil, which has been found better than any other method. The motorist can do this himself by connecting a 12 or 15-ft. length of garden hose to the filler opening of the radiator. The overflow pipe and the space around the hose should, of course, be packed tight with rags to prevent the escape of steam. Start the motor and run it at a moderate speed with the spark retarded, and place a newspaper in front of the radiator to cut down the circulation of air. Open the bottom drain of the transmission and push the open end of the hose inside. As steam comes out, the grease will soon be softened and will flow out. Leave the steam on for about 20 minutes so that the entire transmission unit will be sufficiently hot to dry itself after the hose is removed. The differential can be cleaned in a similar way.

Mailing Tube Removes Necktie Wrinkles



When looking about for some simple method of keeping my neckties in shape without the need of having them pressed so often, I discovered that if the ties were rolled up tightly on a short length of mailing tube, as shown in the drawing, and held in this position by means of a wide rubber band, the wrinkles would disappear. A slot is cut in the tube to receive the doubled narrow portion of the tie, after which the wide part is wrapped around the tube.—H. G. Schultz, Astoria, N. Y.

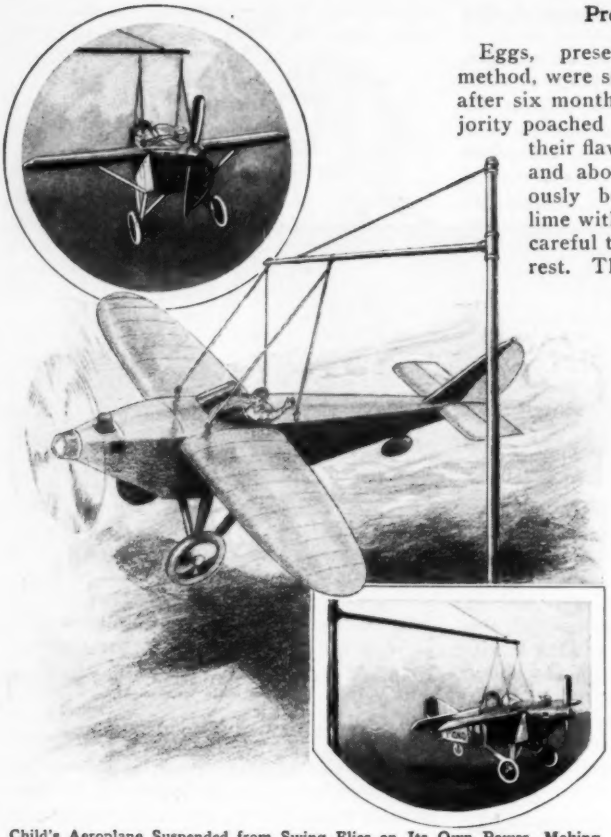
Satisfactory Support for the Camera Tripod on Snow Is Provided with Newspapers

Support for the Tripod on Snow

When the camera tripod is set up in snow-covered ground, difficulty is frequently experienced in adjusting it, as the legs sink into the snow and this prevents them from being moved about easily. It is too unhandy to take along pieces of light wood or heavy cardboard, but a few newspapers carried in one's pocket will serve as well. Folded and tied together as shown, they will make excellent supports.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Removing Scratches in Furniture

To remove light scratches in furniture, go over the surface with a soft rag dampened with kerosene, which will cause all the surface bruises to disappear. If the scratches or cracks are deep, melt a little beeswax and thin it with turpentine to the consistency of sirup. Apply it with a soft cloth and then polish with flannel or velveteen.—William P. Mack, Chicago.



Child's Aeroplane Suspended from Swing Flies on Its Own Power, Making a 20-Ft. Circle in Three Seconds

Backyard Aeroplane Flies on Own Power

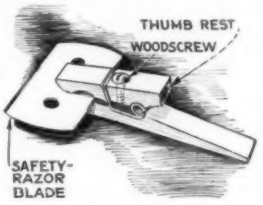
It took me a little over three weeks of spare time to complete the small plane shown in the photos. It is powered by a ½-hp. washing-machine motor, the shaft of which is extended to permit the attachment of a propeller. I found that the motor would pull the plane over a level floor at a good rate of speed. However, I made a swing for it so that it would sail in a circle 20 ft. in diameter. The swing is made of heavy pipe and fittings and securely imbedded in a concrete base. To reduce friction, it is advisable to use ball bearings. When traveling full speed, the plane makes a complete circle in about three seconds.—F. E. Engler, Pukwana, South Dakota.

Preserving Eggs

Eggs, preserved by the following method, were still in such good condition after six months of storage, that the majority poached very well, besides keeping their flavor. Get 2 lb. of fresh lime and about 5 gal. of water, previously boiled. After slaking the lime with 1 gal. of the water, being careful to avoid spattering, add the rest. The solution is stirred quite frequently, allowed to settle and then the clear part, or saturated lime solution, is taken off the top and poured over the eggs. This is better than water glass.

Clothespin Made into Razor-Blade Holder

For cutting stitches, scraping paint from glass, etc., an old razor blade will serve very well. A handy holder for it can be made from a clothespin of the spring type. As the pressure of the spring itself is not sufficient to hold the blade securely, a small wood screw is driven into one lever as indicated, and the upper lever is cut off so that the stub end will serve as a thumb rest. This clamp will also be found to be very useful for holding brass and copper tubing, as it has a firm grip but will not mar the tube.—Durfe Rockwell, Hollywood, California.



¶By moistening the buttonholes of starched clothing on the inside, buttons may be inserted easily without soiling or crumpling the area that surrounds the buttonhole.

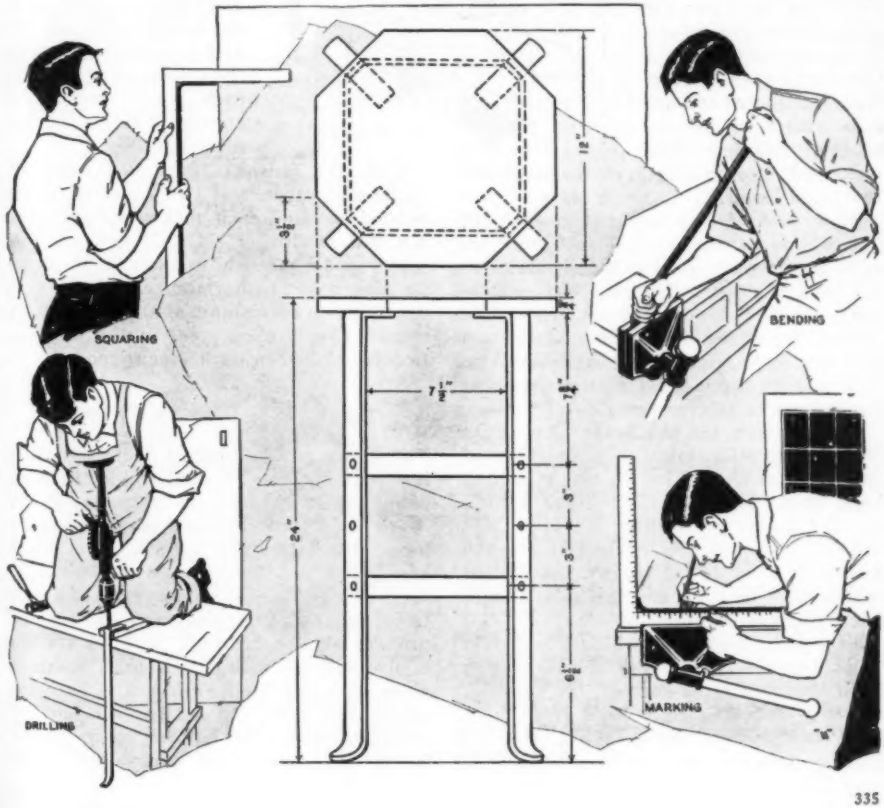
SHOP NOTES

How to Make a Metal Kitchen Stool

By J. W. BOLLINGER

HERE is a real convenience that the lady of the house will appreciate having in the kitchen. It will enable her to sit down to do a lot of work which she would otherwise have to do standing up, and will in the run of a day save her more than enough energy to pay for the slight cost and effort of making it.

The stool is very simple and easy to make. You will need only the tools already in your kit, with the addition of a 3/16-in. drill for metal, to use in your brace or breast drill when making the rivet holes, and a center punch, which you can make yourself. For material, you will need 9 ft. of some 3/16 by 3/4-in. flat or strap



iron for the legs, 6 ft. of ⅛ by ½-in. iron for the braces, and sixteen 3/16 by ½-in round-head iron rivets.

Cut the 3/16-in. iron 27 in. long for each leg. Grind or file the end for the feet round. To curve the foot end, clamp ½ in. of that end of the iron in the vise, and bend the rest of the iron over. It may be necessary to strike it lightly with a hammer, but be careful not to dent it. Make the four feet as nearly alike as possible.

Lay the four legs on the bench with the feet resting against the wall and make a mark across all four pieces 23¼ in. from the bottom. This is where you are to make the bend for the part of the leg which fastens to the top. Make the bends as before, testing them for squareness with a carpenters' square. All four legs must be the same length, or the stool will not stand level.

Measure from the foot end of each leg first 6½ in., then two intervals of 3 in., as in the drawing, for the holes. Be careful to get all four legs marked exactly alike. Make a center-punch mark on the center line of the leg at these places and drill the holes with the 3/16-in. drill. Also drill two or three holes in the part that fastens to the top.

Cut the iron for the braces into eight pieces, each 9 in. long. Clamp ¾ in. of each end of the pieces in the vise, and bend to an angle of 45°. Make a little wooden gauge for testing the bend, and use the same gauge to locate a hole in the center of this ¾-in. length. All eight braces must be alike, and the holes should line up as accurately as possible.

Take two legs and two braces and rivet them together. Put the rivet through from the outside of the leg, lay the iron down so that the rivet head rests on a solid iron surface, say on the vise or on a heavy hammer, and shape the head on the inside. To round the head over, finish by striking around the edge of the rivet with the ball end of a machinists' hammer.

Rivet the other set of two legs and two braces together in the same way, then rivet the other braces in place. Note that the braces alternate on the sides. File the ends of the braces smooth, and test them with the square to see whether they are square with each other; also test the stool to see that it stands level, and that the top is level.

Choose a 12-in. square piece of some strong wood, preferably birch, for the top. You can saw the top out round, if you prefer, or you can make it eight-sided or octagon-shaped, by first squaring it up and then measuring 3½ in. each way from each corner, as shown on the drawing.

Give the finished stool two coats of white undercoat, and two coats of white enamel, sanding each coat when dry with No. 4-0 sandpaper. Or, if you want a more modern finish, lacquer it in some pleasing color, to harmonize with the colored kitchen furnishings that are the latest trend. The kitchen stool in the illustration is finished in dark-green lacquer.

Border Slide Rack for Printers

In most printing offices equipped with linotype machines, border slides are kept loosely in a cigar box or similar container. A New Mexico printer keeps his slides in order in a homemade rack. It is made of a piece of 1 by 4-in. pine, about 2 ft. long, grooved laterally at intervals of about ½ in. on the composing-room saw. The grooves should be made to hold a slide easily, and of such depth that, when a piece of heavy binder's board is bradded across the face and a strip of batting nailed firmly to the bottom, each groove forms a compartment sufficiently large

to hold a slide with enough of the latter projecting to facilitate easy removal. Proofs of borders are pulled and glued over corresponding compartments to aid in quick identification of the slide wanted. —Edgar Sherman, Tucumcari, N. Mex.

Repairing Leaky Storage Batteries

Leaky storage batteries can be repaired without removing either the plates or the jars. Simply pour the acid of the battery into a glass, stone, or rubber jar and dissolve in it one-third cupful of plain gelatine per cell. Allow the mixture to stand for approximately ten hours and then pour it back into the cells. The gelatine does not retard the chemical action of the electrolyte noticeably.

Roller Shade for the Skylight

At times it is desired to have a skylight shaded, which can be readily accomplished by installing a roller shade as shown in the drawing. The brackets supporting the shade are mounted at one end of the sash so that the shade will run lengthwise. A suitable length of cord, attached to the shade stick by means of a screweye, is run through a second screweye driven into the sash, in line with the first, and the cord is then passed over a pivoted pulley fitted on the sash frame. The cord is manipulated from below and must be taut when the shade is drawn away from the roller to prevent it from sagging. It will be found convenient to have a hook on the wall for fastening the cord. The

Roller Shade Arranged on a Skylight Can Be Adjusted from Below

shade can be drawn whether the window is closed or not.—Preston West, Headland, Ala.

Wad of Oil-Soaked Waste Inside of Old Valve Spring Makes Good Thaw-Out Torch

Safe Thaw-Out Torch

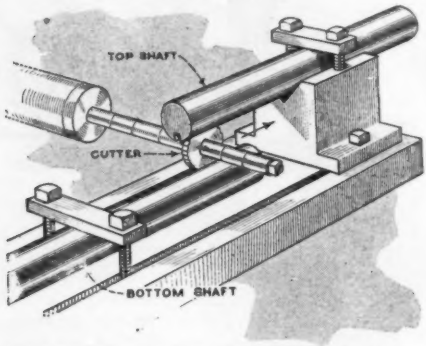
Small thaw-out jobs, which are commonly done with a piece of oily waste hooked to the end of a length of wire, are not entirely safe, as the burning waste may drop off unnoticed with disastrous results. Furthermore, the flame of a loose piece of waste spreads out, and the heat is therefore not concentrated. A better torch can be made as follows: Take an old gas-engine valve spring and loop a fairly long piece of heavy wire through one side, clinching it down as shown in the photo. Pack some waste tightly inside of the spring and soak it in kerosene or other oil. When ignited, it will give a hot flame for a long time and no burning pieces of waste will drop off.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Photographing Silver Cups

When photographing presentation cups, "plate" trophies and other silverware, difficulty is usually experienced in preventing halation or "flare," which is caused by the reflected light from the bright surfaces of the metal. To overcome this trouble, place a piece of ice inside of the vessel just before photographing. The slight condensation formed on the outside surface dims it and enables the photo to be taken without halation.—Thomas Goudie, Rangoon, Burma.

Two Shafts Milled at One Set-Up

A small shop had a large quantity of 2-in. shafts on which keyways had to be

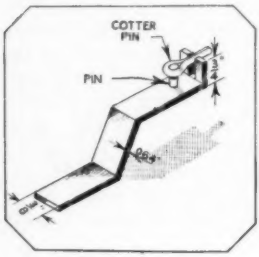


Milling Keyways in Two Shafts at One Set-Up Increased the Production Speed in a Small Shop

milled. As only one cutter was available, the work would have progressed very slowly had the workman not thought of the illustrated method of milling two shafts at one set-up. One shaft was strapped to a T-slot in the table and the other to a V-block suitably packed up on parallels. The cut was started by raising the table and sinking the cutter the required depth in the bottom shaft. The feed was then operated in the ordinary way. At the end of the cut the table was run back to the starting position and lowered to enable both shafts to be removed. By the use of this method, the output was nearly doubled.

Cotter-Pin Holder

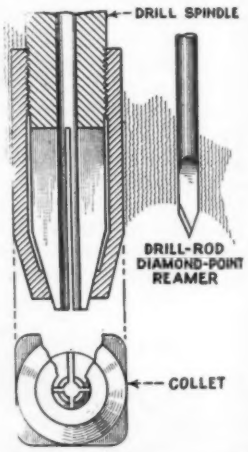
When putting in cotter pins in difficult places, the illustrated device will be found useful. It is made by bending a piece of flat iron to the shape shown and slotting the end to hold the shank of the pin.



Drill a 1/16-in. hole, in line with this slot and about 1/4 in. from it, and drive in a nail, making a tight fit. Cut off the nail so that a small pin is formed which will fit in the eye of the cotter pin, holding it securely in position until the end is started in the hole, after which it is an easy matter to slip the tool off. The tool handle may be as long as desired.—Whitmal W. Hill, Philadelphia, Pennsylvania.

Durable Drill for Difficult Job

In drilling between rivet holes in two malleable-iron plates, it was found that small twist drills cut a clean hole but that a large percentage of the drills broke, as the sharp lips had a tendency to dig into the casting when striking the edge of the holes. It was then suggested to use a piece of drill rod several feet long. A new spindle for the drill was made of tool steel, and a hole, slightly larger than the drill, was bored entirely through it. The shaft was trued up to the hole in its center and a very fine thread was cut on the end. Beyond the thread, the shaft was relieved and finally tapered to a blunt point. Two slots were sawed at right angles to each other, in the end of the shaft nearly to the threaded part, and formed the chuck jaws. From a square piece of machine steel a collet was bored and turned. Its tapered end was made a fit for the spindle jaws. The collet was then relieved up to the end, where a female thread was cut to match the thread on the spindle. The sharp corners of the collet were rounded off, leaving enough of the square to act as a nut for tightening the chuck. The pieces of drill rod used had the ends ground down to the shape of a diamond-point drill. These rods have enormous strength and will twist before they break. If the rod twists or the point breaks, the chuck is loosened



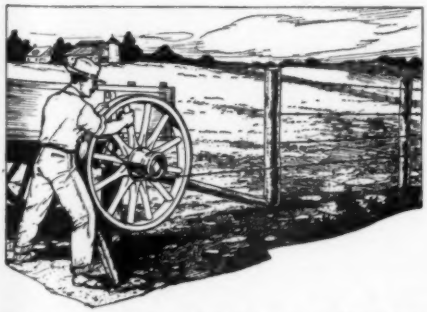
and the rod can then be driven out of the shaft by means of a smaller rod. A new diamond point is ground on the end and the drill put back into service.—Robert Althaus, Moline, Ill.

Knife for Tire Shops Made from Hacksaw

When cutting down tires for retreading, it is important to have a knife with a small surface, as the friction of the blade against rubber makes cutting difficult. Grind the back of a hacksaw blade to a knife-edge and then mount the blade in the saw frame upside down. This will not ruin the blade and will provide an excellent knife for the purpose.—Waldemar Engberg, San Francisco, Calif.

Holding Fence Wire Taut with Wagon Wheel

Holding fence wires taut is a simple matter if the method indicated in the illustration is followed. The end of the wire is tied around a 1-ft. length of 2 by 4-in. or other stock of equal strength, and the piece is slipped between two wagon spokes, the rear end of the wagon having been jacked up so that the wheel is off the ground. Let the wire to be stretched run under the hub and then turn the wheel. When the wire is as taut as desired, set a short piece of 2 by 4-in. stock on the ground and against one of the spokes to prevent the wheel from turning back under the strain of the taut wire. You can then let go of the wheel and staple the wire to the fence post.—A. S. Wurz, Jr., Rockyford, Can.



It Is an Easy Matter to Hold the Fence Wire Taut with a Wagon Wheel

Piece of Cold-Rolled Steel and Old File Make Hard Center

How to Make a Hard Tailstock Center

Turn down a piece of cold-rolled steel rod to the proper size and taper for the tailstock center; then drill a hole in the end to receive a piece of an old rat-tail file. The file is chucked in a brace and is revolved in the hole in the opposite direction to the spiral on the file, until the file fits snugly in the hole. When properly seated, grind down the teeth of the file and break a piece off, as shown in the illustration. Figs. 1 and 2 show the center before and after the piece of file is inserted. Put a quantity of brass or bronze filings and brazing flux into the hole of the center and set it in a vise vertically as in Fig. 3. Play the flame of an oxyacetylene torch against the body of the center until the brass filings melt, and then press the piece of file into position and hold it firmly in place until the metal sets. While still hot, plunge the end into water or oil. Grind the end to shape as shown in Fig. 5, and the tool is finished. Care must be taken to prevent the flame from coming in contact with the piece of file, as this would remove its hardness. I have found that centers made in this way wear much longer, without regrinding, than ordinary centers, and are not so apt to be scored.—C. R. Van Druff, McLouth, Kans.

How To Make Spiral

LAYING OUT SPIRAL

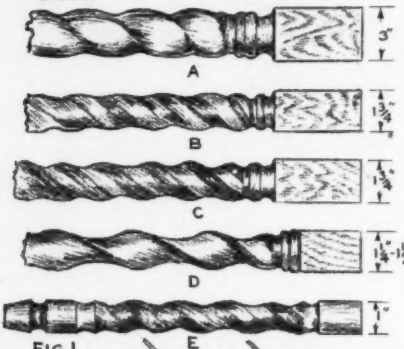


FIG. 1

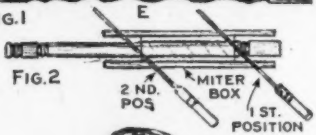


FIG. 2

LAYING OUT SHORT TURNING WITH COPING SAW

IT IS almost safe to say there is no branch of what might be termed "hand" woodworking that is so well adapted to the effort of the individual worker, and has in addition the feature of displaying the worker's skill to such excellent advantage as hand-made spiral turnings.

The first consideration is, of course, the design of which the spiral turnings are to be a part, and it must be remembered that considerable variation is possible in the form, size and pitch of the spiral itself. Several examples of the different forms of spiral turnings are shown in Fig. 1. The sizes given for the square end of the pieces in the first four designs are, of course, arbitrary. The first, A, looks well in a piece of massive proportions such as found in the older period designs. The next two forms, B and C, are suitable for a wider range of projects. Turning D is especially pleasing in a small stand or end table where the legs are close together on a secondary base, both ends of the turning in this case being left square. The last, E, is the simplest possible form, being turned from a length of 1-in. dowel rod. This is made wholly by hand and will appeal to those not possessing a bench lathe.

The turnings supporting the magazine rack pictured are made from two sizes of dowel rods, the legs of the same form, as at E in Fig. 1. The crosspieces and stretcher are made from a length of ¾-in. rod, while the legs are 1 in. in diameter. The larger wall desk pictured on page 343 has the two legs and crosspieces of the form B, with the center stretcher of form D, turned on a piece of the same diameter as the legs. The two pieces illustrated are intended to be merely suggestions.

Taking as an example the turning of the form E, the first step is to cut the pieces for the upright posts or legs to length from the 1-in. dowel. Cut them all to the same length and square at the ends. Dowel stock of maple or beech is the best to use as it makes a strong assembly and can be dressed very smooth. Mark the location of the concave rings at the lower

Turnings

by W. Clyde Lammey

end of the leg in the same position on all pieces. This done, tighten the piece in the vise with the marked end projecting and run the ring about the circumference with a coarse wood rasp, using the convex side and cutting not quite as deep as the thickness of the tool. Do this with all four pieces, smoothing the cut with a fine rasp of the same size.

No elaborate layout is necessary to start the turning. Locate two points exactly opposite at one end on the circumference of that portion of the leg which is to be formed into the spiral. This may be done with dividers or simply with the eye, which latter means will be accurate enough for the short lengths. Make a simple miter box by ripping out a bottom from ordinary stock to 1⅛ in. in width and about 8 in. long. For the two sides, cut two pieces to the same length and rip to about 3½-in. width. Nail these to the bottom to form the box. Set the T-bevel to 45° and strike a line at this angle across the top edges of the sides and approximately in the center. Square down from this line on the outside and saw down the line with a small back or dovetail saw. Place the end of the leg in the miter box with one or the other of the marks directly under the saw. Start the saw cut on this mark, making the kerf not more than ¼ in. deep—less is better—and continue to saw with a light stroke, turning the leg slowly with the left hand. If this is done carefully, the cut will progress accurately about the circumference owing to the angle of the saw. The first cut finished, begin the second, starting on the opposite mark. It is necessary to be very careful not to cut over ¼ in. deep (about ⅛ in. is better or the saw kerf is likely to show in the finished work). The principal use of the saw kerf is to aid in starting and guiding the rasp

FIG. 3

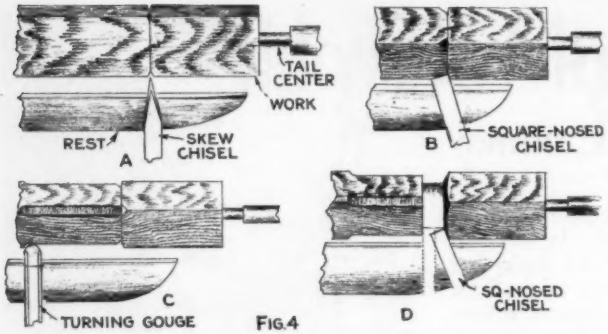


FIG. 4

and nothing is gained by cutting it deeper than necessary to form a guide when working out the spiral.

Next, tighten the piece in the vise at a convenient angle, and, using the coarse rasp first, begin on the saw mark at the end of the piece. Instead of following this single mark along the work, cut down to a trifle less depth than the thickness of the rasp and as far each way as handy, then move to the second kerf without shifting the piece. In this way, rasp out the several marks that appear on what is the top of the piece in this position. Now give the piece a quarter turn and proceed with the rasp in the same manner. This method will save much time and continued shifting of the work in the vise. Be careful to get the cuts as nearly even in depth as possible, and be very particular to keep on the line of the saw mark. Be careful at the end that the rasp does not mar or deface the portion of the leg that is to be left round.

With the spiral roughed out, the next step is the rounding of the flutes or ribs of the spiral and smoothing of the spaces. First use the fine rasp, following in the groove made by the first cut, and giving the tool a rolling motion by turning the handle slightly as the stroke is made. Take out all ridges and unevenness in the grooves, bringing them to a uniform depth, which, for this size of turning, should be about the thickness of the tool. To round the shoulders of the flutes, make the stroke in the groove as before, but hold the rasp very nearly at right angles to the piece, as in the illustration on page 341 showing this operation. Give the tool the same rolling motion during the stroke as before and vary the angle slightly at the same time. With a little practice, this operation will round the shoulders very neatly and far more quickly than sanding or a lengthwise stroke of the tool along the shoulder. The method also prevents the edge of the tool from striking the bottom of the grooves and saves the continued shifting.

With the above operation completed, the work is ready for the final finish by sanding with fine sandpaper. Obtain several sheets of No. 1-0 garnet paper, and tear or cut them into 2-in. strips the long way of the sheet. From a piece of heavy cloth or canvas, cut several strips, 2 in. wide and about 18 in. long, and glue these to the strips of sandpaper, having the cloth on the back of the paper, of course, and allowing the ends of the cloth to project beyond the ends of the paper strip to afford a smooth, comfortable handhold. Tighten the turning in the vise and draw the sandpaper back and forth over the ribs of the spiral, using considerable pressure and holding the ends of the cloth close together beneath, as in the drawing on page 341. Finally rasp and sand the lower end of the leg to the form shown in Fig. 1, E. The above operations complete the single leg for the magazine rack and will apply in essentials to the making of any of the forms in Fig. 1.

The lathe work on larger sizes is worthy of careful consideration and as careful execution. Plain oak squares look best in the larger sizes. Walnut is also an excellent wood for the purpose and is easily worked with hand tools; among the cheaper grades, gum, birch, and hard maple are good. The latter three turn especially well, but are not so easy to work with the rasp as oak and walnut. Use only clean, seasoned stock, carefully planed and squared. Cut the pieces to be turned to exact and uniform length, using the miter box or power saw to insure a square cut at the ends. The lathe centers must be accurately located on the ends of the stock.

Sharp tools are absolutely essential to good work. Where the rounded center section on which the spiral is to be formed meets that portion of the end which is to be left square, the corners must be cut down neatly without splintering. While there are a number of ways of doing this, the method perhaps best suited to this particular work makes use of the skew chisel when doing the first scoring cut on the corners. Fig. 4 shows the principal operations on the shoulder, following the sequence indicated by the letter.

On most table-leg assemblies, and those like that on the wall desk illustrated, it will be seen that a portion must be left square at or near the lower end to present a square shoulder to the crosspiece or stretcher. This phase of the design should be given careful consideration. The design of the leg assembly in the wall desk pictured on this page is a common one for this particular size of turning. Where the size and type of the turning is like that shown in the drawing Fig. 1, A, the stretcher is usually placed between the two front legs and the short crosspieces and back legs are left square. A dowel is turned on the square ends of the front stretcher and this joins a square on each front leg, making a solid joint. The square portions of the legs and stretcher must be carefully laid out to exact measurement beforehand.

Most common designs of spiral turning feature beads at each end of the spiral, as in Fig. 1, with a concave rounding groove or ring between the beading and the ends of the spiral. This groove is essential where the spiral is worked out by hand as it allows room for handling the rasp when forming the ends of the turned work. It is best that the space between the end of the spiral and the square shoulder be not more than 2 in.

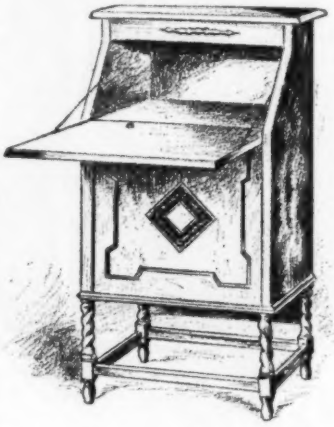
Owing to the square parts of the leg, the laying out of the spiral by means of the saw as described before requires a miter box constructed as in Fig. 2, which may be made of any suitable odds and ends of stock. The principal consideration is the length of the box. If the spiral is to be 20 in. long the bottom of the box must be only 10 in. long, the two inner pieces forming the sides being the same length and the two outer pieces about 18 in. in length. The sides are then nailed securely to the bottom, the longer pieces

SANDING IN THE LATHE

SPIRAL AFTER SANDING

on the outside, as in Fig. 2. For the average-size turning, the sides should be about 6 in. wide. The angle determining the pitch of the spiral may range from 30 to 60°, the lesser pitch being better for the larger sizes, and 45° for the medium size. A saw kerf is made at each end of the box as shown in Fig. 2, the angle in this case being 45 degrees.

The bottom of the box is ripped to a width about ⅛ in. greater than the diameter of the turning. This is important, as the sides act as guides and determine the accuracy of the layout. Tighten the box in the vise and place the turning in the position shown in Fig. 2, with one of the marks, previously made opposite each other on the circumference, directly under the saw. When sawing, turn the work with one hand as the blade progresses, but do not push against it; the fact that the blade is running at an angle will cause it to advance the work of its own accord. Do not use any end pressure.



When the shoulder of the leg prevents its further travel, place the saw in the kerf at the other end (second position) and slide the work back until the blade engages the original cut, which may then be continued. The second laying-out cut is made in the same way, starting on the point opposite the first cut. If the work is carefully done, the layout will be accurate. After the layout is made, the turning is roughed out, finished up and sanded in the manner described before.

It will be noted from Fig. 1 that the first four designs all differ somewhat in form. That shown at B is the easiest to turn out by hand. When making the roughing cut with the coarse rasp on the form at A, instead of holding the rasp flat across the work as at A in Fig. 3, turn it more on edge and make the cut deeper and narrower. The other portion may then be easily rounded to the form shown. The pitch angle of form D, Fig. 1, is made about 60° and the greater part of the work is done with the coarse rasp, after which it may be quickly sanded smooth and to form in the lathe, as in the illustration on page 343. Turn a cylinder of wood, 8 or 10 in. long, to such diameter that the arc will approximate that of the spiral groove, and tack a piece of medium-grit paper about this as a drum. Hold the work with the groove bearing on the revolving drum, turning the work slowly back and forth.

If the design of the project calls for a very short turning, the spiral being less than 10 or 12 in. in length, the layout of the spiral may be made accurately enough without a miter box. The drawing on page 340 shows how the laying out is done with the coping saw. With a little care a very accurate layout may be made in this simple way. Any slight irregularity is easily corrected when making the roughing cut. On the longer pieces always use the miter box.

As a rule, the turning should be finished before it is put in position on the project. In this way, the finishing is much more easily and effectively done. If the wood is walnut or oak it must be filled. Unless the oak is to be left in the natural, stain a prepared filler to the desired shade and thin it with turpentine until it will spread with a brush. Before filling, make sure that all rough spots have been cleaned up with the sandpaper or the fine rasp. Tighten the work in the vise and spread the filler on the spiral with the brush. Get a piece of heavy cloth, about 20 in. long, and fold it several times. When the filler begins to set, rub with the cloth, holding it at both ends and drawing it back and forth in the same manner as when sanding. On the first turning, it may take several applications to fill the cloth with the excess filler so that the rubbing fills the wood satisfactorily. Continue the operation on the first turning until the cloth has collected a coating of the filler. The pieces may then be coated with the filler and rubbed with the same cloth successively. Be par-

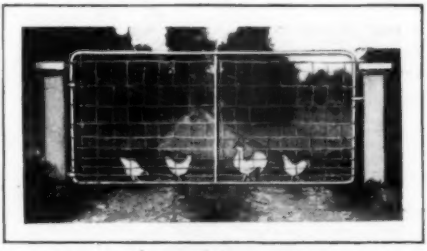
ticular to get the surface evenly filled, as only a good job of filling will produce a satisfactory finish on open-grained woods.

After the filling and staining have been done, and the work has been allowed to dry thoroughly, give the spiral two or three coats of rubbing varnish or clear lacquer. Allow this to become thoroughly hardened and then rub down with pumice-stone. Use a piece of cloth folded the same as in filling, soak this in rubbing oil or crude oil and sprinkle the pumice on the cloth. Be careful in rubbing down, for the pumice cuts very fast and is likely to cut through the finish film unless carefully watched.

If it is desired to have a fine finish, remove all traces of the pumice and follow with a clean cloth and rottenstone, the cloth being soaked in the oil as before and the powder sprinkled on the surface until the cloth collects a film of the abrasive. Clean up with turpentine and finally with a dry cloth.

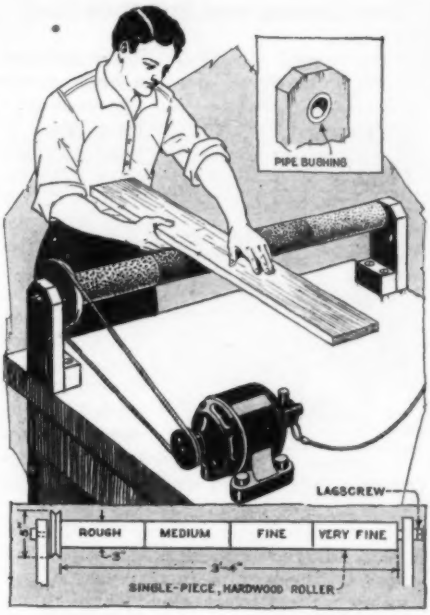
Tin Chickens Decorate Farm Gate to Warn Motorists

The chickens shown in the photo are not flesh and blood but are made of tin. The farmer's purpose in doing this was, first, to prevent motorists, who had the habit of turning around in the driveway, from breaking the gate, which frequently occurred before the tin chickens were mounted on it. The "chickens," however, are so lifelike that motorists are now very careful of the gate. The second purpose was to advertise the product of the farm at the roadside and this method



Tin Chickens, Carefully Painted to Make Them Appear Realistic, Mounted on Front Gate

proved highly effective, as the farmer is always sold out of eggs and broilers.—J. L. Graff, Park Ridge, Ill.



Four Different Grades of Sandpaper Are Mounted on This Cylindrical Sander

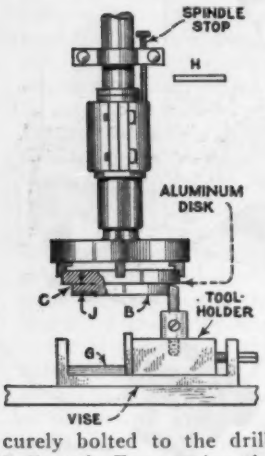
Simple Power Sander for the Workshop

Ordinarily one grade of sandpaper is used on a sander, but the cylindrical sander shown in the illustration is especially made to take four pieces, ranging from a very fine to a coarse grade. It consists of suitable endpieces securely mounted on a table or bench with holes drilled to receive bushings made of pipe, which serve as bearings. Lagscrews, fitting nicely in the bushings, are driven into the ends of a 40-in. length of 4 by 4-in. piece of clear-grain wood, turned to cylindrical shape.

Expanding Aluminum Piston for Insertion of Pin

Aluminum pistons of the type having tight wristpins and the upper end of the rod bushed, must be expanded by means of heat in order to insert the wristpin. This is often done with warm water, but a less troublesome method is to invert the piston and pour a little gasoline into it. The gasoline is ignited and allowed to burn out, expanding the piston sufficiently to permit insertion of the pin.

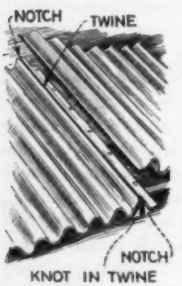
Turning on a Drill Press



For turning a large quantity of aluminum disks, a small machine shop successfully uses a drill press, as shown in the illustration. The disks are faced off at B, and the shoulder C turned at one chucking. A vise and tool-holder are securely bolted to the drill-press table as indicated. For turning the shoulder C to its correct diameter, a piece of steel, G, is placed in the vise and acts as a positive stop. This piece is then removed and another piece of steel, H, is placed under the spindle stop, which raises the spindle the distance J, and a cut is then taken over B. Obviously the pieces H and G keep the work uniform. When a lathe is not available, this method is excellent.—C. Kugler, Philadelphia, Pa.

Oiled Twine Seals Corrugated-Iron Roofing Laps

Frequently the laps of corrugated-iron roofing allow rain and snow to enter. A successful remedy is to file a small V-notch in the top and bottom of the last ridge where the next piece will fit over it.



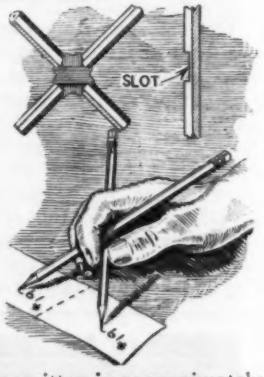
Procure some heavy cord or twine, such as binder twine, and soak it in linseed oil. Cut off a length to fit between the notches, and then knot the ends so that the twine can be slipped through the notches and the knots will hold it taut on the ridge. Lay the next piece of roofing in place, allowing it to lap over the twine. A lap of only one corrugation is necessary. Where a horizontal joint is made, the same method may be used.—Luther Strosnider, Onaga, Kans.

Starting Auto Motor in Cold Weather

Short-circuiting the resistance coil on the spark coil of a car in order to provide more current for the coil when the battery is low, or to assist in easy starting during cold weather, has been found effective. However, instead of mounting a switch on the instrument board for this purpose, it is better to make a connection to the starter terminal, so that the short circuit will be made automatically. This allows the coil to receive full voltage when it needs it most as is the case when a cold, stiff motor is being turned over.

Twin Pencils Save Time in Copying

A stock-room worker whose job consisted in supplying the factory with castings, was required to write two tags for each order, one to go with the material and the other for the files. As hundreds of these tags were issued each week it took a large part of his time to fill them out. To save time he tied two pencils together as shown and by this means could write both tags at once. After a little practice the tags could be written in approximately half the time formerly required.



Drilling Hard Iron Castings

It was quite a problem, in a small machine shop, to drill some cast-iron valve bodies owing to their hardness; even drills hardened in acid had little effect on the work. It was a cold winter night and the stove was red-hot, which gave me an idea. I placed all the valve bodies into the stove on the hot coals. After they

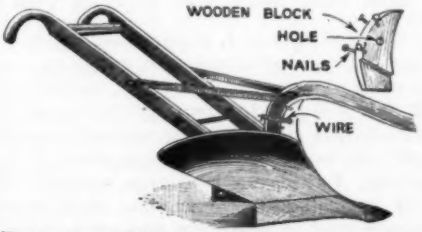
had been heated sufficiently, I transferred them into another stove, which I had filled with ashes for slow cooling. The drilling was then accomplished with ease. Another job involved the truing of some large-diameter pulleys which were covered with a very hard scale. The cutting tool would not stand up when the lathe was revolving at full speed, so I did not start the lathe until I had turned it over several times by hand in order to remove the hard crust. Then the job was easy. —J. A. Homewood, Long Beach, Calif.

Removing a Tight Nut

After all of the usual methods had been tried, it was still found impossible to remove a nut on a 2-in. rod as it was firmly set by rust. At last, the following method was tried successfully: A small electric drill was used to make a row of ¼-in. holes side by side across one flat side of the nut. Then a wrench was applied. As the nut was nearly cut through on one side and greatly weakened, the two halves pulled apart slightly under the twist of the wrench, and the nut was removed.

Guard Block Keeps Plow Free from Rubbish

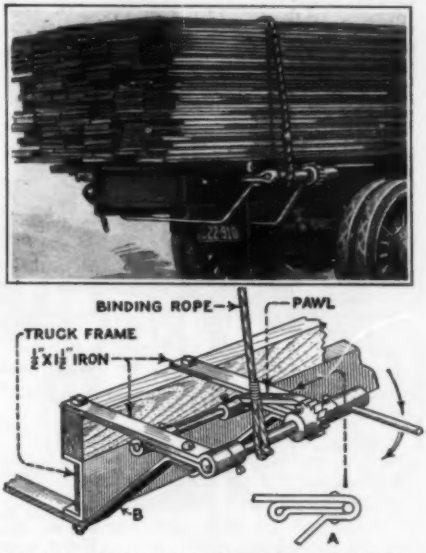
A plow usually drags more or less rubbish in the crook of the beam just above the moldboard. By fitting a wooden block as shown in the drawing, this trouble can be entirely overcome. The block is shaped to fit the beam and is held in place securely by means of four nails, two on each side of the beam. A length of wire also is used to tie the block and beam together to obtain additional strength. The block should have a 3-in. face on the moldboard side.—Adolph Rieter, Marinette, Wis.



Wooden Guard Block Attached to Plow Beam Keeps It Free from Rubbish

Load-Binding Winch for the Truck

When hauling material for factory or farm, a motor truck becomes of greater



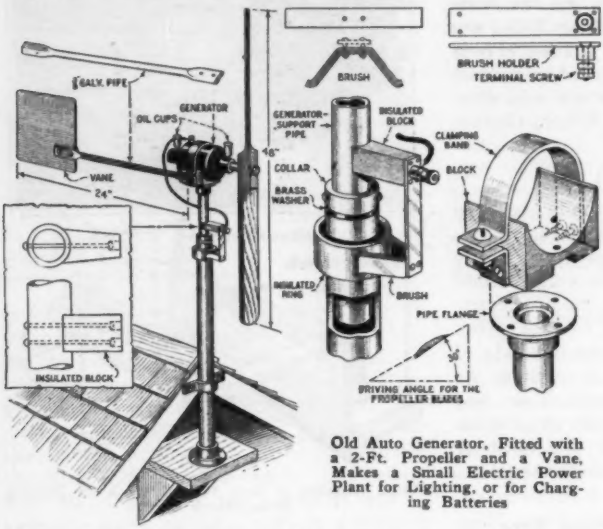
Winch Attached to Rear End of Truck for Holding Down Heavy Loads

service if some quick and efficient method of binding the load to the truck is used in order to prevent shifting. The illustration shows a winch that will serve this purpose well and can be attached to any truck. The shaft and ratchet wheel are made from the jackshaft of an old truck or auto transmission. The brackets supporting the winch are made of ½ by 1½-in. flat steel. A suitable pawl is provided to engage the teeth of the wheel as the winch is turned. All details of construction are clearly shown, but where the material on hand is not exactly similar to that illustrated, it may be necessary to deviate from the method of construction to some extent. A rope is better than a cable for use in binding down a load as it does not cut the corners of lumber or wear through sacks, although it stretches somewhat, making it necessary to tighten the winch once or twice on a long trip.

¶Steam-pipe drains should be provided at all points in the line where water is likely to accumulate.

Wind-Driven Auto Generator Makes Electric Power Plant

Those who wish to have a small electric power plant capable of furnishing sufficient electricity to light a few lamps, or to charge a battery, will find the apparatus shown in the illustration entirely practical for the purpose. This device was built at a negligible cost and was put into successful use by a West Virginia farmer. It consists of a Ford generator arranged to pivot on a pipe support. The pipe should be long enough to project 2 or 3 ft. above the roof when set on a wooden shelf in the extreme upper part of the gable. The pipe is held on the shelf by means of a flange, and additional rigidity is obtained by clamping it to the edge of the roof with a strap. An insulated ring is fitted on the top of the pipe, which is done by driving a narrow brass or copper ring over an insulating bushing of fiber, rubber or similar material. Both ring and bushing should be a drive fit, so that they will not be dislodged easily. A short piece of shafting or pipe is fitted in the upper end of the support pipe and must be just loose enough to turn with minimum friction. If possible, it is better to provide a thrust bearing in the upper end of the support pipe, than to fit a collar on the shafting to ride on the edge of the pipe. The detail on the right-hand side of the drawing shows the generator mounting, which is made from a block of hardwood. Strips of flat metal are bent to fit over the generator to clamp it securely on the block, being fastened to the latter by means of suitable wood screws. An insulating block is fastened to the shafting that holds the generator, to carry a flat length of brass fitted with a brush for making contact with the insulated ring, and also a binding post to which connection is made from one terminal of the generator. The other side of the generator is grounded and the pipe support is used as a conductor. The output leads to the lights or battery (not shown in illustration) are connected to the insulated ring, and to the pipe support at some suitable point. Large oil cups are substituted for the small cups with which the generator is equipped. The attachment of a light and well-balanced propeller and a vane to keep the propeller in the wind, complete the device. A 2-ft. wooden propeller, having two blades beveled at a 30° angle, was found highly satisfactory. However, for a high-speed generator, a propeller having four or six blades may be necessary. The vane is made of galvanized sheet iron, fastened to the generator by means of a length of ⅜-in. pipe, which is flattened, drilled and cut at the ends as shown.—G. A. Luers, Washington, D. C.



Old Auto Generator, Fitted with a 2-Ft. Propeller and a Vane, Makes a Small Electric Power Plant for Lighting, or for Charging Batteries

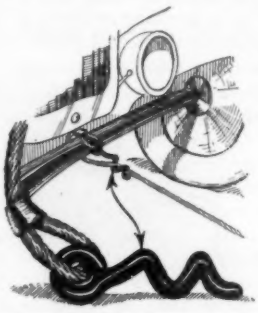
Boat Paint Made from Dry-Cell Tops

Some time ago I acquired an old boat and did not feel justified in going to any great expense in painting it. Melted tar is not suitable for sealing cracks, as it gets brittle upon cooling and will break off. In looking around for a cheap substitute, I discovered a large number of old dry cells. I removed the black substance used to seal them and melted this, but as it was too thick and gummy for use,

I proceeded to find a solvent to thin it. Ordinary paint oil would not mix well with it, but creosote was found highly satisfactory. I applied this "paint" to the boat hull and it sealed all the cracks effectively, drying in about 20 hours. In this case the mixture consisted of equal parts of melted cell tops and creosote. In the proportions of one part of melted cell tops and two parts of creosote, it proved satisfactory for furnaces and stoves. White lead mixed with this paint makes it yellow or brown, depending on the proportions. Yellow paint, made in this way, was used for the inside of the boat hull.—Sidney Cornell, Southport, Connecticut.

Towline Hook That Will Not Loosen

Most towline hooks have a tendency to get loose, but this can be overcome by using a worm hook as shown in the illustration. The hook has a large eye to receive the end of a steel cable, which is looped through it and tied securely. In use, the hook and part of the cable are slipped around the axle of the car to be towed, and the cable is given a couple of twists so that it enters the corkscrewlike turns of the hook, engaging with it firmly. —Joe Chmelar, St. Louis, Mo.



How to Preserve Fence Posts

Place the ends of thoroughly dried posts in lime water, about 1½ in. deep, for about 15 minutes. Then take them out and let them dry, after which paint them with a solution of sulphuric acid and water in the proportion of 1 to 6. The acid should always be poured into the water and this should be done slowly to avoid having the hands or clothing spattered with the liquid.—Vernon V. Johnson, Spokane, Washington.

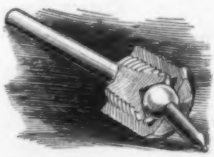
Handle for Wire Solder Is Made of Pipe, and Remains Cool While Soldering

Handle for Holding Wire Solder

When in constant use, wire solder becomes uncomfortably hot. To avoid this, an electrician made the handle shown in the drawing. A short piece of ¼-in. pipe was drilled and split at one end and bent as indicated to form a reel holder. The wire was threaded through the pipe and a few inches of it drawn out of the end. As the solder is needed, it is pushed through the pipe and the handle remains cool, regardless of the amount of work.

Universal Diamond-Tool Holder

The diamond-tool holder shown in the drawing can be turned around to any position, so that a new edge will be brought in contact with the wheel. In addition, the turning of the diamond tends to produce new sharp edges. It is assumed that the shank is fitted in a holder that rests on a magnetic chuck. The ball is held tightly or loosely by turning the shell.—C. Kugler, Philadelphia, Pa.



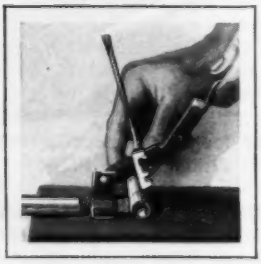
¶The small dust cap usually found on Ford tires will fit the grease-cup connection on the model-A Ford water pump.

Storm-Proof Door for Sheep Shed

Burlap Sack Partly Filled with Sand Keeps Doorway of Sheep Shed Closed against Wind and Snow

Shelters for sheep on many farms have open entrances so that the animals can run in and out. Although this freedom is said to be essential to the health of the flock, the high winds and drifting snow are a danger, often costly, at lambing time. A Wisconsin farmer, therefore, decided it would be profitable as well as humane, to provide a wind and storm-proof door for the shed. A small quantity of sand was poured into a large burlap sack, which was then nailed above the doorway to act as a curtain. The weight of the sand holds the curtain suspended so that the opening is closed against the strongest wind, yet the sheep may enter or leave without difficulty.

Cutter for Glass Tubing



For cutting glass tubing of the smaller sizes the jig shown in the photo has been found practical. An old Ford door-latch handle and part of the latch box were used to make the cutter holder. One side of the latch box was cut away and a portion of it having a screw hole was bent to form a foot, which was securely fastened to a block of wood with a heavy screw. A 7/32-in. hole was drilled through the handle to take a short 5/16-in. bolt fitted with a nut to hold the cutter. A small strip of wood was tacked to the block to hold the tubing under the cutter a little off center and away from the strip. In use, the tubing is rotated while the handle is pressed down.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Trench Used as Silo

Instead of a concrete silo, a Nevada farmer keeps ensilage in a trench dug in the ground. It is first covered with straw and then with dirt. The trench is 6 ft. wide and 100 ft. long.—G. Perrins, Ogden, Utah.

Tool for Cleaning Furnace

Removing hardened soot from the corrugations inside of a furnace radiator is a rather difficult task, as the small doors on each side of the fire door and at the back do not allow the hand and arm much space to work with a tool of large size. To circumvent the difficulty, get an old gas-tractor engine valve, heat it about an inch from the head and bend it at right angles as shown. Wrap the stem with a piece of an old inner tube and tie it on securely to form a handle. This improvised tool can be worked up and down the corrugations, no matter how cramped the quarters.

Method of Restoring Old Oil Paintings

The curator in an eastern museum uses the following method of restoring old faded oil paintings: He touches up the darkened lights of the picture with a small sable brush dipped in a mixture consisting of one part of dioxide of hydrogen and six or eight parts of water, by weight.

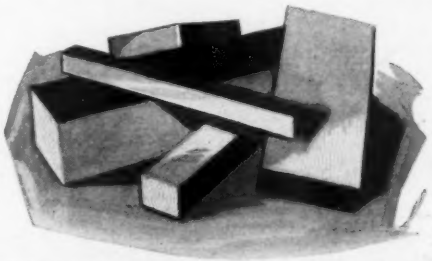
After this treatment, the original luster returns. It is necessary, of course, to wash the painting thoroughly with a clean sponge and water before applying the mixture.—Vernon V. Johnson, Spokane, Washington

Opening Locked Cars without Key

When the key to the auto door has been lost, it is sometimes necessary to open it by pushing up the floorboard and releasing the catch. It is not possible to reach the catch from below with the fingers and therefore a length of stiff wire must be used. A rifle-cleaning rod of the cheap wire sort, with a loop on the end, makes a good tool for this purpose, as it is straight and fairly stiff. Ford model-A closed cars can be opened by raising the hood and drilling a ⅜-in. hole through the dash, about 4 in. above and 1 in. to the outside of the steering column. This will allow a long stiff wire to be inserted. The hole may be closed by brazing on a patch, but this involves some risk of fire.

Blocks to Raise Photographed Objects

When making photos of machine parts, or other objects for catalog work, and the like, it often becomes necessary to raise or block up the piece in order to get the best view. In such cases the operator usually uses any small object that comes to hand, such as a match box, an empty spool, book, etc. This, of course, has to be blocked out in the finished negative, which requires both skill and time. The work can be greatly reduced or entirely eliminated by using small painted blocks of wood. They should be of various sizes, painted black on one end and two adjacent sides, and flat white on the other end and two remaining sides. The blocks are placed so as to present either black or white sides to the camera according to the color of the background.—Warren N. Crane, Brooklyn, N. Y.



Black and White-Painted Blocks Aid Photographer in Adjusting Objects

Pedal Depressor for Adjusting Brakes

When adjusting brakes single-handed, the illustrated pedal depressor will be found highly convenient, as it can be set to hold the brake down at any desired point. It is made from an old auto jack, the base is cut off, and a handle is riveted to the side gear. The body of the jack is slipped into a length of pipe fitted with a tee to take a length of hardwood or smaller pipe. The latter is placed across the hinged supports of the driver's seat when the car is of the coach type with individual front seats, but is not necessary on other cars. A pin is driven through the lower end of the pipe to serve as a stop for the jack. In use, the pedal is gradually depressed, and at each position of the pedal the brakes are adjusted so that they are perfectly equalized.—John A. Blaker, West Auburn, Massachusetts.

Pedal Depressor, Made from Old Auto Jack, Helps When Adjusting Brakes Single-Handed

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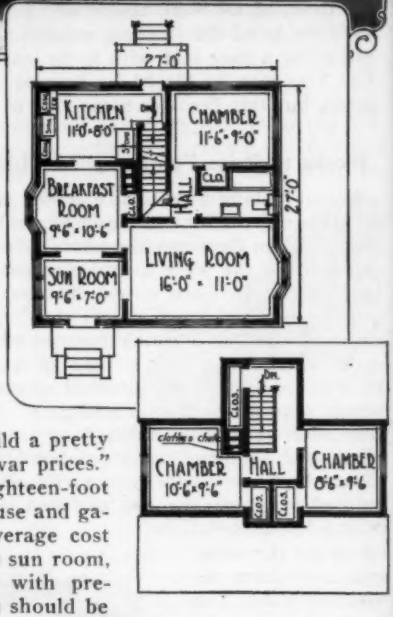
PLAN 6-W-60



If You Are Long On Ambition and Short On Cash

"YOU'RE right," \$3,675.02 seems like a mighty low price for a well-built seven-room house. But here are the figures," said lumberman Robb, who recently built this colonial bungalow. "As a matter of fact, by careful planning and wise spending you can build a pretty fine house today at little more than before-the-war prices."

The total does not include an eighteen by eighteen-foot garage added later at a cost of about \$300. House and garage therefore amounted to \$3,975.02. The average cost of each room, and there are seven including the sun room, was \$525. This amount compares favorably with pre-war per-room costs. What is more, this house should be duplicated in most any average town, outside the large cities, for about the same money.

Let's look into the plan and equipment of this bungalow and see what you get for your money. The first floor is a complete bungalow. One bedroom may be all a family of two—newlyweds or old folks—require. Even so, there are two more bedrooms above.

Every inch of floor space does duty. The house is of frame construction with siding exterior and red-cedar edge-grain shingle roof. Insulation is obtained by use of patent lath.

Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for \$1, and a new bungalow book will be sent for ten cents.

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